Occupational Rehabilitation

Studies and Research Projects

REPORT **R-835**

Comparative Evolution of Pain and Work Status Following a Rehabilitation Program for Workers with Musculoskeletal Disorders

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IRSST – Communications and Knowledge Transfer Division
505 De Maisonneuve Blvd. West
Montréal, Québec
H3A 3C2
Phone: 514 288-1551
Fax: 514 288-7636
publications@irsst.qc.ca
www.irsst.qc.ca

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Patrick Loisel
University of Toronto

Marc Corbière, Marie-José Durand, Marie-France Coutu
Université de Sherbrooke et CAPRIT

Bruno Désorcy, Quan Nha Hong, Karine Genest
CAPRIT

Clic Research
www.irsst.qc.ca

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PEER REVIEW

In compliance with IRSST policy, the research results published in this document have been peer-reviewed.

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SUMMARY

Musculoskeletal disorders (MSDs) affect more than 45,000 Québec workers every year in all activity sectors. In a biopsychosocial model of MSDs, the issue of the beliefs held by the main stakeholders about disability and pain is central to the rehabilitation process. Many health professionals, employers, and insurers believe that injured employees should not return to work until they have completely recovered from their injury. Paradoxically, others believe that only a tenuous relationship exists between work absence and pain. To the best of our knowledge, little work has focused to date on the correlation between perceived pain and work status. This study sought to fill that gap.

The aim of the study was to gain a better understanding of the correlation between the evolution of pain intensity perceived by an individual with an MSD and his[1] work status and reintegration into his usual activities. Two specific questions were addressed: (1) what are the profiles of pain intensity evolution in workers with MSDs, and (2) what are the differences in the profiles of pain intensity evolution when sociodemographic variables (age, gender, pathology, number of weeks of work absence), work status, and reintegration into usual activities are taken into account.

A retrospective study was done using data collected between 1997 and 2009 in the clinical unit of the Centre d'action en prévention et réadaptation de l'incapacité au travail (CAPRIT, or Centre for Action in Work Disability Prevention and Rehabilitation). This study drew on a database containing clinical information on workers who had participated in the PRÉVICAP rehabilitation program, as well as information gathered in the follow-ups performed at one and three years post-program. Hierarchical cluster analyses, k-means cluster analyses, and statistical correlation measures (chi-square and ANOVA) were used for the data analysis.

Cluster analyses by profile of pain intensity evolution were performed using data on 107 workers who had taken part in the PRÉVICAP program and in the one- and three-year follow-ups. Significant correlations were observed between work status at one and three years post-program, reintegration into usual activities, and profiles of pain intensity evolution. The workers who experienced a decrease in their pain intensity had a higher rate of employment and of reintegration into their usual activities at the three-year follow-up than those whose pain increased over time. It would appear therefore that the evolution of perceived pain intensity is related to work status.

[1] The masculine gender is used throughout this document solely to facilitate reading and has no discriminatory intent.

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1. INTRODUCTION AND KNOWLEDGE REVIEW

In Québec, as in many industrialized countries, persistent pain related to musculoskeletal disorders (MSDs) places a heavy economic burden on society (Deyo & Phillips, 1996; Deyo & Tsui-Wu, 1987; Elders *et al.*, 2000; Phillips, 2006). It also implies high social costs and has a major impact on the quality of life of the persons affected (Baril, Martin, Lapointe, & Massicotte, 1994; Phillips, 2006; Winkelstein, 2004; Young Casey, Greenberg, Nicassio, Harpin, & Hubbard, 2008). MSDs affect an average of more than 45,000 Québec workers annually across all activity sectors (Institut national de santé publique du Québec, 2010). At the Commission de la santé et de la sécurité du travail du Québec (or CSST, which is Québec's worker compensation board), MSDs represent on average 35% of all the occupational injuries reported and accepted (Institut national de santé publique du Québec, 2010). Also in Québec, spinal disorders alone cost some $516 million in 2007 (CSST, 2008). A similar scenario is found in the industrialized countries, where the cost of back ailments alone represents the equivalent of one-fifth of overall health expenditures, or three times the costs associated with cancer and 1.5% of the gross domestic product (Phillips, 2006).

According to the Québec Survey on Working and Employment Conditions and Occupational Health and Safety (Stock *et al.*, 2011), 63% of the worker respondents had experienced musculoskeletal pain that bothered them during their activities during the 12 months prior to the survey (Stock *et al.*, 2011). Of these workers, 72% considered this pain to be related to their then-current work and 17% had been absent from work due to this pain (Stock *et al.*, 2011). Approximately three-quarters of the workers who had been absent from work were off for fewer than 10 working days (Stock *et al.*, 2011). However, 7% of them had been off work for a period of 60 working days or more (Stock *et al.*, 2011).

In the past two decades, a number of studies have investigated the management of workers on sick leave (Campbell *et al.*, 2007; Durand, Vézina, *et al.*, 2007; Elders *et al.*, 2000; Franche *et al.*, 2005; Staal *et al.*, 2002; Waddell, Burton, & Kendall, 2008; Williams, Westmorland, Lin, Schmuck, & Creen, 2007). The results of work disability studies have profoundly altered our understanding of the causes of long-term absence in some workers. The factors that prevent workers from returning to their jobs are not only associated with the disease involved in the absence but also, and primarily, with psychosocial and environmental factors (Loisel *et al.*, 2001). Evidence-based data indicate, for example, that a person's satisfaction or dissatisfaction with his work, his feeling of alienation from his workplace, the duration of his absence from the workplace, job loss, job stability, and his expectations of his return to work are predictive of long-term absence from the workplace (Linton, 2000; Waddell, Burton, & Main, 2003). This major transformation in our understanding of the consequences of diseases and traumas in terms of work absence has enabled us to shift from a **"**medical**"** model, which places great weight on understanding and treating the disease, to a biopsychosocial model that factors the complexity of the human being and his environment into the problem of work absenteeism (Engel, 1977; Loisel *et al.*, 2005; Schultz, Stowell, Feuerstein, & Gatchel, 2007; Waddell, 2004).

Evidence-based data is now rooted, therefore, in the disability paradigm, in which long-term work disability is no longer seen simply as the consequence of a deficiency (lesion), but rather as the result of interactions between the physical and psychological health parameters of

the injured person and his environment. The latter in turn comprises three major social systems: the healthcare system (responsible for treating the disease), the work environment (more or less favourable to the return to work under acceptable conditions), and the financial compensation system (which varies according to the legal and social context) (Loisel *et al.*, 2001). To foster the return to work of individuals with an MSD, it is therefore a matter of going beyond the medical diagnosis and of endeavouring to grasp what it is in the interaction among personal, social, and environmental characteristics that will enable these disabled workers to return to work or maintain an active working life.

Pain is a constant, however, in work disability when MSDs are involved and a major contributor to loss of quality of life in the individuals affected. Over the past two decades, numerous studies have shown that pain is a key determinant in the development of long-term disability (Shaw, Pransky, & Fitzgerald, 2001; Truchon & Fillion, 2000; Waddell *et al.*, 2003). Several biopsychosocial models have been proposed to improve understanding of the physical, psychological, and social factors related to persistent pain (Turk, 1996; Waddell, 2004). In a biopsychosocial model of MSDs, the issue of the beliefs held by the main stakeholders about disability and pain is seen as key to the rehabilitation process (Feuerstein, 1991; Loisel *et al.*, 2001; Nachemson, 1999; Waddell, 2004). Many health professionals, employers, and insurers believe that injured employees should not return to work until they have completely recovered from their injury (Waddell, 2004). Numerous studies have concluded that pain intensity is a predictor of the return to work and of long-term work absence (Corbière, Sullivan, Stanish, & Adams, 2007; Dionne *et al.*, 2005; Gauthier, Sullivan, Adams, Stanish, & Thibault, 2006; Karjalainen *et al.*, 2003; Mngoma, Corbière, & Stevenson, 2008; Schultz *et al.*, 2004; Vowles, Gross, & Sorrell, 2004). Moreover, in a cohort study conducted in six countries (five European countries and the United States), Hansson and Hansson (2000) found that pain intensity was the factor that best predicted the return to work. However, these studies simply show a correlative but not causal relationship. Several criteria for causality, such as time order and directionality, are not demonstrated. One could, for example, hypothesize that conversely it is work status that explains the pain. Paradoxically, some studies assert that only a tenuous link exists between work absence and pain (Durand, Berthelette, Loisel, Beaudet, & Imbeau, 2007; Sullivan, Bishop, & Pivik, 1995; Truchon, 2001; Waddell, Aylward, & Sawney, 2002), in other words, that pain intensity and work status do not necessarily go hand in hand.

There is an abundance of literature that seeks a better understanding of the factors explaining the persistence of pain (chronicity) and disability (McIntosh, Frank, Hogg-Johnson, Bombardier, & Hall, 2000; McIntosh, Frank, Hogg-Johnson, Hall, & Bombardier, 2000; Shaw *et al.*, 2001; Truchon, 2001; Truchon & Fillion, 2000; Turner, Franklin, & Turk, 2000; Waddell *et al.*, 2003). These studies use (or survey other studies that use) a variety of dependent variables (outcomes), including the persistence of pain, claim rate, return to work, duration of work absence, and disability. These variables are not always well defined, and sometimes the review articles do not differentiate between them. Yet the distinctions are important as they could allow different factors to be identified. Gauthier *et al.* (2006) further observed that the predictors of return to work differed from the predictors of disability at the end of the intervention. For example, in their study, catastrophic thinking and pain severity at the beginning of the intervention helped predict the return to work, but not disability (Gauthier *et al.*, 2006).

To enhance understanding of the relationship between pain intensity and work status, some researchers have focused on different pain intensity profiles. Corbière *et al.* (2007) examined the relationship between pain, depressive symptoms, and the return to work in injured workers with chronic pain who participated in a pain and long-term disability prevention program. This program consisted of a ten-week standardized cognitive-behavioural intervention aimed at increasing participants' involvement in their usual activities during the post-traumatic period and at minimizing the psychological barriers to progress in rehabilitation (Sullivan & Stanish, 2003). Cluster analyses were used to distribute the sample into four groups that reflected fluctuations in pain and depressive symptoms over time. Pain intensity was measured at the time of registration in the program, half-way through treatment, at the end of treatment, and four weeks later. The results revealed that fewer individuals with a high level of pain and high or moderate level of depressive symptoms returned to work (18% to 21%) than workers with a lower level of pain and milder symptoms of depression (61% to 85%). Moreover, Mngoma *et al.* (2008) investigated the pain profiles of patients with low back pain who were registered in an outpatient return-to-work rehabilitation program. This basic physiotherapy program was adapted to the participants' needs and lasted an average of 56 days. The basic components of the program were as follows: (1) initial evaluation, (2) prescription of exercises, (3) education, and (4) comfort. Two groups of participants emerged from the cluster analyses: those with a severe level of pain and those with a moderate level of pain. The return-to-work rate was considerably higher among workers suffering from moderate pain levels (90%) than among those with severe pain levels (31%). The results of these studies show the importance of further investigating the correlation between perceived pain and work status, taking pain intensity profiles into account.

2. OBJECTIVES

The aim of this study was to gain a better understanding of the correlation between the profiles of the evolution of pain intensity perceived by individuals with an MSD and their work status and reintegration into their usual activities. The participants in this research project were workers with an MSD who participated in the PRÉVICAP rehabilitation program between 1997 and 2009.

The specific questions addressed by the research team were as follows:

1. What are the profiles of pain intensity evolution in workers with MSDs who participated in a work rehabilitation program?

2. What are the differences in the profiles of pain intensity evolution when sociodemographic variables (age, gender, pathology, number of weeks of work absence), work status, and reintegration into usual activities are taken into account?

Both questions were exploratory.

3. METHOD

3.1 Study design

A retrospective study was carried out of data collected between 1997 and 2009 in the clinical unit of CAPRIT (Centre d'action en prévention et réadaptation de l'incapacité au travail), located in Longueuil, Québec. This study made use of the MIS (management information system) database, which contained the workers' clinical information. The workers whose cases were managed at CAPRIT had been on sick leave for an average of six to eight months and therefore can be considered cases involving persistent pain (Frank *et al.*, 1996; Waddell, 2004). The program was personalized for each worker. The duration of the program, calculated from the time when the patient was taken in charge, ranged from one week to several months. The average duration for the patients in this study was 14 weeks (standard deviation of 7.5). All the workers managed under the PRÉVICAP program were considered to have completed the program. Also, follow-up was done of all the workers at one and three years following their discharge. This follow-up consisted of a short telephone interview conducted by administering a questionnaire on the status of their symptoms, pain intensity, work status, reintegration into their day-to-day and leisure activities, and treatments received from other health professionals for the problem in question (see Appendix A). All the follow-ups were conducted by a research professional who was independent of the PRÉVICAP program and who was specially trained to administer the questionnaire. For those participants not reached on the first call, the research professional made at least two other attempts to contact them on different days and at different times.

This project was approved by the Research Ethics Committee of Hôpital Charles LeMoyne. All the workers who were managed under the PRÉVICAP program signed a consent form authorizing the health professionals and researchers to consult the data on their occupational injury and to contact them for follow-up at one year and three years post-intervention. The analyzed data were anonymized so that no worker could be identified.

3.2 Description of the program

The PRÉVICAP rehabilitation program is essentially based on the Sherbrooke model. The Sherbrooke model is a clinical and ergonomic program aimed at preventing the long-term work absence of patients with thoracic-lumbar pain. The program was tested in a randomized trial conducted in 30 companies in Québec (Loisel *et al.*, 1997; Loisel *et al.*, 1994). The aim of the randomized clinical trial was to pilot an innovative program for managing back pain, specifically, work-related low back pain in the subacute phase, among a worker population in the Sherbrooke, Québec region. This model consists of an integrated approach based on evidence-based data and guided by both the worker and his workplace. The results of the study showed that the Sherbrooke model enabled the participants to return to their regular work 2.41 times ($p < 0.01$) faster than conventional programs (Loisel *et al.*, 1997). The costs generated by the disability were thus significantly reduced at the six-year follow-up (Loisel *et al.*, 2002). This project was made possible thanks to the financial contribution of the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) (0090-1160).

The success of the Sherbrooke model contributed greatly to the development of new expertise in the prevention of long-term disability at the regional, national, and international

levels (Loisel *et al.*, 2003). Recognizing this major contribution, in 1996 the public health directorate of Québec's Montérégie region gave CAPRIT a mandate regarding the prevention of work-related musculoskeletal disabilities. The objective was to prevent long-term work absences by creating and implementing a rehabilitation program grounded in evidence-based data. The main characteristics of the PRÉVICAP rehabilitation program were as follows: (1) the management of workers on sick leave that was attributable to an MSD; (2) the fast integration of real work into the rehabilitation process; (3) a stable, strongly cohesive interdisciplinary team; (4) systematic collaboration between the insurers' rehabilitation counsellors and the clinical teams, and (5) the establishment of a collaborative dynamic between the employer and the attending physician. The interdisciplinary team consisted of the following professionals: ergonomist, occupational therapist, kinesiologist, physician, and psychologist. The PRÉVICAP program involved two key activities: (1) the Work Disability Diagnostic Interview (WoDDI), the main purpose of which is to rule out a serious diagnosis and to formulate a (biopsychosocial) diagnosis of the cause(s) of the prolongation of an inability to perform regular work or of a condition making work difficult (Durand, Loisel, Hong, & Charpentier, 2002); and (2) the therapeutic return to work, which consists of a gradual, supervised return to the regular job or a similar job, first with light tasks and then gradually increasing the work demands, pace, and duration in light of the employee's capacities through to full resumption of the usual work (Durand, Loisel, & Durand, 2001).

A complete description of the PRÉVICAP rehabilitation program (Durand & Loisel, 2001; Durand, Loisel, Charpentier, Labelle, & Hong, 2004; Durand *et al.*, 2001) and its evaluation (Rivard *et al.*, 2011) have already been published elsewhere, and therefore, only the key components of the program are described below. Briefly, the criteria for admitting workers to the program were as follows: (a) having had a work disability and/or a work intolerance of musculoskeletal origin for over three months; (b) having been absent from regular work (work hours and tasks) or from all work; (c) being between 18 and 65 years of age; (d) having maintained an employment relationship in the province of Québec; (e) being compensated by a public or private insurer (the Québec health insurance board does not cover the costs of this type of intervention); and (f) having a concrete and true occupational goal. The average duration of the program, which was personalized according to the workers' needs, was 14 weeks. It was established in cooperation with the clinicians on the interdisciplinary team and the rehabilitation counsellor.

A weekly follow-up, involving all the internal and external stakeholders, was performed to monitor the worker's evolution. A schedule for the following week, including meetings with the clinicians, as well as a proposal of the tasks to be performed and amount of time to be worked, was given to the worker each week. For example, the week's schedule could include meetings with (a) the kinesiologist, to improve physical performance; (b) the psychologist, to reduce fears about pain and movement, and (c) the ergonomist and occupational therapist, for a visit to the workplace. The criteria for being discharged from the program were as follows: (a) having achieved the main objective, namely, a return to the pre-injury job or another job; or (b) having reached a plateau in terms of level of functioning or improvement, but with insufficient progress to return to the pre-injury job. The team of clinicians deemed that the individual had progressed to his maximum level when he met these criteria. The progression to work exposure depended on a team consensus and on the concept of a sufficient margin of maneuver or leeway

(Durand *et al.*, 2011). However, the final decisions to terminate the intervention and return the worker or not to work were taken at the administrative level under the responsibility of the CSST's rehabilitation counsellor with or without the agreement of the clinical team. Although the file review process was time-consuming, the PRÉVICAP program was relatively consistent over time. It was actually divided into three phases: (1) the Work Disability Diagnostic Interview (WoDDI); (2) the period of reactivation, known as the pre-therapeutic return to work; and (3) the therapeutic return to work. The evaluations of this program were standardized and each of the components was explicitly described elsewhere (Durand, Berthelette, *et al.*, 2007). The disciplines delivering the different parts of the program remained the same. Lastly, all the files were reviewed by the team coordinator, who also trained the members of the interdisciplinary team. All these elements corroborate the assertion that the program was relatively consistent over time.

3.3 Measures

In the context of the PRÉVICAP program, pain intensity was measured on three different occasions: at the start of the program and at the one-year and three-year post-intervention follow-ups. This variable was measured using a numerical pain-rating scale. The person was asked to rate his pain on a scale of 0 to 10 (an 11-point scale), where 0 represented "no pain" and 10, "extreme pain that could not be worse." The level chosen by the respondent represented his pain intensity score. This is one of the most frequently used methods of measuring pain severity (Von Korff, Jensen, & Karoly, 2000). The validity of the pain-rating scale used has been well-documented (Turk & Melzack, 1992). Numerous studies have shown a strong correlation between the numerical pain-severity rating scale and other pain intensity measures (Durand & Loisel, 2001; Rivard *et al.*, 2011; Turk & Melzack, 1992). It is also sensitive to changes resulting from treatments that target pain (Chesney & Shelton, 1976; Keefe, Schapira, & Williams, 1981; Paice, Cohen, & Nurs, 1997; Stenn, Mothersill, & Brooke, 1979). This particular scale was chosen because it is easy to administer in person or in a telephone interview.

The first pain-intensity measure was obtained during the worker's initial evaluation (Work Disability Diagnostic Interview, or WoDDI) by the team physician, while the follow-up measures (at one and three years post-intervention) were collected by a research professional who was independent of the PRÉVICAP program. In addition, at these one- and three-year post-intervention follow-ups, information was collected on work status and reintegration into usual activities. In this project, each worker's work status was treated as a binary variable: (1) back at work or (2) not back at work due to an MSD or some other reason (e.g. unemployment, return to studies, or pregnancy). The *reintegration into usual activities* variable was also treated as a binary variable: (1) resumption of no or only a few usual activities, and (2) resumption of most, if not all, usual activities.

Other variables, such as age, gender, pathology, and number of weeks of work absence, were used to verify the possible correlation between these variables and the profiles of pain intensity evolution.

3.4 Statistical analyses

First, chi-square and variance analyses were performed to compare the sample retained (group of workers with complete data; n=107) to the rest of the population of workers managed under the PRÉVICAP program (n=353). They were compared for the following variables: gender, age, pathology, and number of weeks of work absence.

Second, *cluster analyses* (Rapkin & Luke, 1993) were performed to identify common profiles of the evolution of pain intensity over time. The data collected at the start of the program and at the one- and three-year follow-ups were used to create several profiles of pain intensity evolution. Cluster analysis has proven effective in other studies of populations with acute, subacute, and chronic pain (Bergstrom, Bodin, Jensen, Linton, & Nygren, 2001; Boersma & Linton, 2006a; Corbière *et al.*, 2007; Mngoma *et al.*, 2008; Talo, Forssell, Heikkonen, & Puukka, 2001) and is recognized as a robust method for distributing individuals into homogeneous groups. Actually, these types of analyses refer to a group of methods whose purpose is to regroup a set of data into different homogenous subsets where the data in each subset share common characteristics. It is worth noting that cluster analysis is essentially an exploratory procedure and does not test hypotheses.

Hierarchical cluster analysis was performed first to determine the number of profiles (clusters) in our sample. In light of the surveyed literature on recent studies analyzing workers' pain profiles (Corbière *et al.*, 2007; Mngoma *et al.*, 2008), the data on the pain intensity evolution were tested with two, three, and four profiles. Then, k-means cluster analysis was performed to group the individuals. This last procedure is used to identify relatively homogeneous observation groups by means of an algorithm and according to selected characteristics, in this case, pain intensity. However, the algorithm requires indicating the number of profiles (clusters) desired at the end of the procedure. As pointed out by Bergstrom *et al.* (2001), the interpretability and clinical usefulness of the solution must also be considered in the procedure. Variance analyses (ANOVAs) followed by Tukey's post-hoc B test were then performed to verify the difference between the profiles retained.

Chi-square (χ^2) tests and ANOVAs were used to assess differences in the pain intensity profiles relative to age, gender, pathology, and number of weeks of work absence, all measured at the start of the PRÉVICAP program. Lastly, a chi-square (χ^2) test was used to measure statistical correlations between the return-to-work rate, the resumption of usual activities, and the fact of belonging to a given class.

4. RESULTS

4.1 Description of the sample

A total of 298 telephone follow-ups were carried out at one year post-program and 212 follow-ups at three years post-program of the 460 workers enrolled in the PRÉVICAP program. Again among these 460 workers, 188 telephone follow-ups were carried out with the same workers at one and three years post-program. Of the 188 workers whose cases were managed and who answered the one- and three-year post-intervention follow-up questionnaire, 81 had missing data for one or more of the variables listed in section 3.3. Given that the aim of this project was to study the profiles of pain intensity evolution, the research team decided to retain only those workers for whom they had complete data.

In summary, 107 workers answered all the questions at the one- and three-year follow-ups and were retained for the analyses performed in this research project. The participants' mean age was 43 years (SD: 8.46) and 72% were men. Table 1 provides more detailed information on both groups: the one with complete data and the one with incomplete data.

Table 1: Comparison of group of workers with complete data with group of workers with incomplete data on gender, average age, pathology, and number of weeks of work absence

	Group with complete data n=107	**Group with incomplete data n=353**
Gender		
Male *n* (%)	77 (72)	255 (72)
Female *n* (%)	30 (28)	98 (28)
Mean age in years (SD)	42.61 (8.6)	39.67 (8.99)
Pathology		
Back *n* (%)	67 (62.6)	212 (60.0)
Upper extremity or neck *n* (%)	29 (27.1)	82 (23.2)
Multi-sites and/or other MSD *n* (%)	11 (10.3)	59 (8.2)
Number of weeks of work absence	50.30 (37.87)	51.31 (41.75)

Statistical analyses revealed no significant difference between the groups with regard to gender (χ^2= 0.09; df = 1; p = 0.761), pathology (χ2= 2.83; df = 2; p = 0.244), and number of weeks of work absence (t =0.223; df = 451; p = 0.824). However, a significant difference was found regarding age (t = 2.997; df = 451; p = 0.03), in that the group with complete data was slightly older (43 years versus 40 years).

All the workers were on sick leave when they began the rehabilitation program. Table 2 describes the follow-up results for the sample (n=107) at one and three years post-intervention,

with regard to work status and reintegration into usual work activities that had been abandoned due to the MSD.

Table 2: Comparison of work status and reintegration into usual activities previously abandoned due to the MSD, at the one- and three-year follow-ups (n=107)

	1-year follow-up n (%)	3-year follow-up n (%)
Work status		
Back at work	72 (67)	80 (75)
Not back at work	35 (33)	27 (25)
Resumption of activities		
Most/all	54 (51)	58 (54)
None/a few	53 (49)	49 (46)

4.2 Cluster analysis

Hierarchical cluster analyses were performed to distribute the individuals in our sample into different groups, taking into account the pain intensity values collected at the start of the program and at the one-year and three-year follow-ups. An examination of the hierarchical tree and the percentage of individuals in each group showed that the three-profile solution provided the most revealing pattern in terms of the evolution of pain intensity. A *k*-means cluster analysis was then performed using a three-profile solution. The profiles obtained were subsequently associated with the employment rate and reintegration into usual activities at the three-year follow-up.

The three profiles were named as follows: (1) decrease in pain, with low intensity at the start of the program (n=38); (2) decrease in pain, with high intensity at the start of the program (n=28); and (3) increase in pain (n=41). Figure 1 shows the means, the employment rate, and reintegration into usual activities for each of these profiles.

A variance analysis (ANOVA) confirmed a significant difference between the three profiles with respect to pain intensity at the start of the program ($F = 30.982$; ddl = 2; $p = 0.00$), at the one-year follow-up ($F = 42.243$; ddl = 2; $p < 0.01$), and at the three-year follow-up ($F = 79.736$; ddl = 2; $p < 0.01$). Tukey's post-hoc B test revealed that at the start of the program, profile 2 (decrease in pain, with high intensity at the start of the program) differed from both profile 1 (decrease in pain, with low intensity at the start of the program) and profile 3 (increase in pain). At the one-year follow-up, profile 1 differed from both profiles 2 and 3, whereas at the three-year follow-up, all the profiles were different. These results therefore confirm the presence of significant differences between the pain evolution profiles over time, with respect to pain intensity.

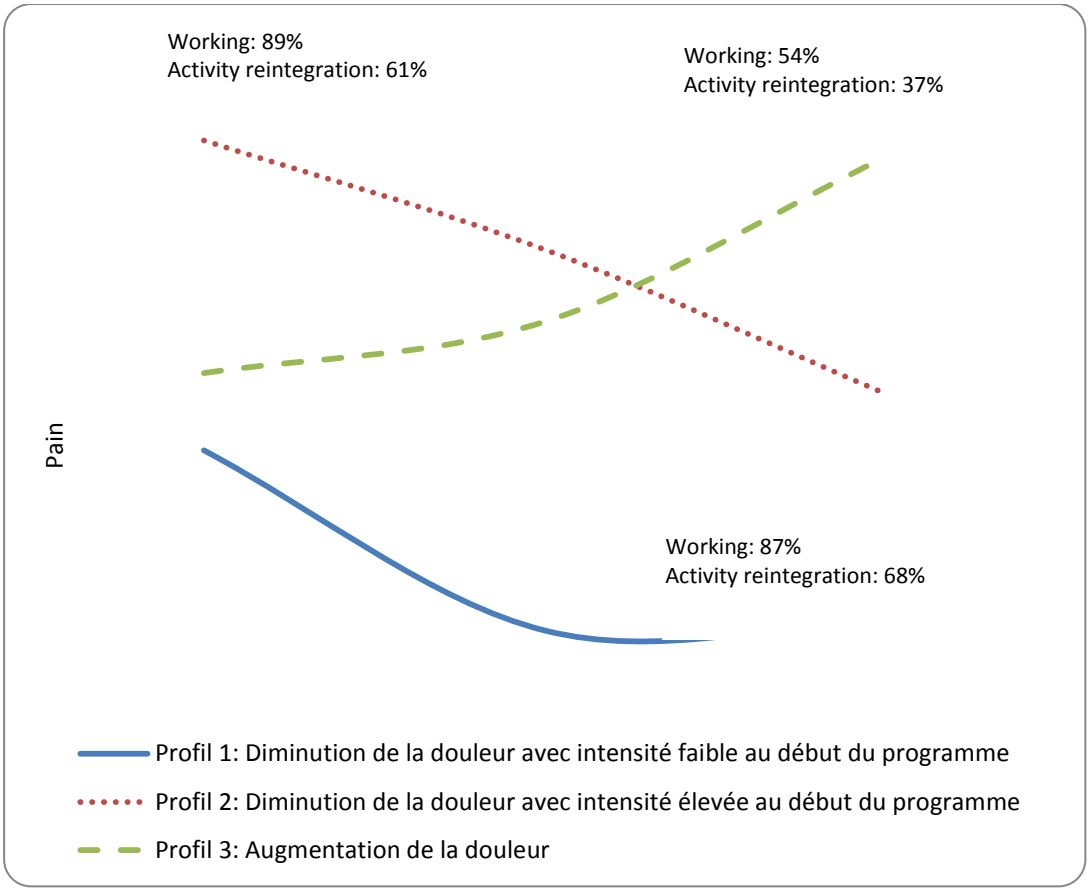

Figure 1: Profiles of pain intensity evolution at the start of the program and at the one-year and three-year follow-ups and their correlations with work status and reintegration into usual activities[2]

Chi-square and variance analyses were also used to verify the relationships between gender, age, pathology, and number of weeks of work absence and the different profiles of pain intensity evolution. The results of these tests, shown in table 3, did not reveal any significant difference between the three profiles across the aforementioned variables.

[2] Profile 1: Decrease in pain, with low intensity at the start of the program
Profile 2: Decrease in pain, with high intensity at the start of the program
Profile 3: Increase in pain

Table 3: Comparison of pain profiles taking into account data collected at the start of the program and at the one- and three-year follow-ups, as well as age, gender, pathology, and number of weeks of work absence

	Profile 1	Profile 2	Profile 3	ddl	Chi-square	F	Value of p
Gender							
Male (n)	29	17	31	2	2.383		0.304
Female (n)	9	11	10				
Pathology							
Back (n)	23	19	25	2	3.273		0.513
Upper extremity or neck (n)	13	5	11				
Multi-site or other (n)	2	4	5				
Age							
Mean	41	43	44	2		0.640	0.529
(Standard deviation)	(8.3)	(9.3)	(8.1)				
Number of weeks of work absence							
Mean	73	66	67	2		0.785	0.459
(Standard deviation)	(52.1)	(36.7)	(41.3)				

Profile 1: Decrease in pain, with low intensity at start of the program; Profile 2: Decrease in pain, with high intensity at start of the program; Profile 3: Increase in pain.

When associated with the *work status* and *reintegration into usual activities* variables, these profiles indicate that the participants who experienced a decrease in pain intensity, regardless of whether the intensity was low or high at the start of the program, had a higher rate of employment after a three-year period (87% and 89% versus 54%; $\chi^2 = 15.748$; ddl = 2; $p < 0.01$), as well as a more significant reintegration into usual activities (68% and 61% versus 37%; $\chi^2 = 8.699$; ddl = 2; $p = 0.01$) than the participants who experienced an increase in pain (figure 1).

5. DISCUSSION

The main objective of this study was to identify the profiles of pain intensity evolution in a population of workers who were off work due to an MSD and whose cases had been managed under the PRÉVICAP rehabilitation program, and to observe their correlation with sociodemographic data (age, gender, pathology, and number of weeks of work absence), work status, and reintegration into usual activities. Hierarchical and k-means cluster analyses were performed using the data collected on pain intensity at the start of the program and at the one-year and three-year follow-ups. Chi-square and variance analyses revealed differences between the profiles of pain intensity evolution and the sociodemographic data, resumption of work, and reintegration into usual activities.

The workers included in this study were on long-term work disability, having been absent from their jobs for at least three months (Frank *et al.*, 1996). The cohort consisted mainly of men whose mean age was 42.61 years (SD: 8.46). The main injury site was the back (63%).

In this study, an examination of work status at the three-year follow-up revealed that at least 75% of the respondents were working (table 2), a high proportion if compared to a similar population having a chronic work disability. In fact, the probability of returning to work dwindles with time (Crook & Moldofsky, 1994; Stay-at-Work and Return-to-Work Process Improvement Committee, 2006; Waddell, 2004; Waddell *et al.*, 2003). Workers absent from work for six months have a 50% chance of returning to their jobs, while the probability of workers who have been absent for one year or more returning to work is virtually nil (Waddell, 2004). However, when the profiles of pain intensity evolution are examined separately (figure 1), only 54% of the respondents who experienced an increase in pain were working compared to 87% or more of the respondents who experienced a decrease in their pain, regardless of whether their pain level at the start of the program was high or low. These results are comparable to those obtained by Mngoma *et al.* (2008), who examined pain profiles of patients suffering from subacute non-specific low back pain and registered in an outpatient return-to-work rehabilitation program. The pain profiles obtained by Mngoma *et al.* (2008) are quite similar to those obtained in this study. Their “moderate pain” profile, which involved a decrease in pain intensity (4.7 to 1.04), is comparable to our “decrease in pain, with low intensity at the start of the program” profile (3.95 à 2.30). By contrast, their “severe pain” profile (7.15 to 5.46) compares to our “decrease in pain, with high intensity at the start of the program” profile (6.95 to 4.5). However, in our study, we obtained a third profile: “increase in pain.” This difference could be attributable to the time interval between the follow-ups, which was very short (56 days) in the Mngoma *et al.* (2008) study compared to three years in our project.

Furthermore, for all profiles combined (moderate and severe levels of pain) in the study by Mngoma *et al.* (2008), 78.5% of the patients returned to work after completing the rehabilitation program. By contrast, only 30.8% of the respondents with a “severe pain” profile returned to work compared to 90.4% of those with the “moderate pain” profile. Again in the Mngoma *et al.* (2008) study, the mean time elapsed between the two measurement times was 56 days, which may explain why the difference in return-to-work rates between their profiles was greater than that obtained in our study. Also, based on our results, it would appear that the

evolution of the *perception* of the pain rather than the actual *intensity* of the pain per se is related to work status. Other studies also support this result (Corbière *et al.*, 2007; Dionne *et al.*, 2005; Gauthier *et al.*, 2006; Hansson & Hansson, 2000; Karjalainen *et al.*, 2003; Mngoma *et al.*, 2008; Schultz *et al.*, 2004; Vowles *et al.*, 2004).

Apart from differences in the evolution of the pain intensity, the profiles do not necessarily differ with regard to work status and resumption of usual activities, as can be seen in profile 1 (decrease in pain, with low intensity at the start of the program) and profile 2 (decrease in pain, with high intensity at the start of the program). In fact, as pointed out by Frank *et al.* (1996), Waddell (2004), and Loisel *et al.* (2003), the link between level of pain and level of functioning is not linear. A high level of pain is not always associated with functional disability, and functional disability is not always proportional to level of pain. Many biological factors (e.g. medical status or physical capacity), psychological factors (e.g. fear, anxiety, motivation, or depression), and social factors (e.g. work environment or family) come into play (Loisel *et al.*, 2005; Loisel *et al.*, 2001). Moreover, the job demands, which are not all the same, must also be taken into account when considering work status. Despite the fact that all the workers in this project were off work at the start of the PRÉVICAP program and in the chronic phase of an MSD, they did not all return to work, regardless of the level of pain intensity (high or low). In addition, given that we found no significant difference between the pain profiles with regard to the number of weeks of work absence (table 3), it is clear that the return to work is not influenced solely by the intensity of pain felt.

The determination of the level of pain intensity remains a totally subjective piece of data, specific to the worker, but theoretically, its evolution could be influenced by his representation of his situation. If the work appears threatening, the pain could increase, which then creates situations of avoidance and confrontation, as described in the cognitive-behavioural model of pain-related fear developed by Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen (2002). This is consistent with the results obtained by Coutu, Durand, Loisel, Goulet, & Gauthier (2007), who demonstrated that pain intensity is not associated with quality of life. Another study has also shown that it is important to look at the representation of pain, not simply the perception of pain, which is essentially sensory in nature (Coutu, Baril, Durand, Côté, & Rouleau, 2007). For example, the following questions could be asked: “where am I in relation to my ideal?”, “what would be satisfactory?” and “is my situation improving or deteriorating?”

Moreover, it is important to point out that since our study was not predictive in nature, no discriminatory analysis was performed, and it is not possible, based on this project, to determine into which profile of pain intensity evolution a new patient would fall. Future research projects could include the development of pain management interventions for workers with MSDs. These interventions could help the workers not to perceive pain catastrophically, thus preventing them from developing a feeling of fear. Vlaeyen & Linton (2000) in fact developed the fear-avoidance model, which describes the role of avoidance behaviours in the development and maintenance of disability. According to this model, the pain felt after an injury or movement is interpreted catastrophically. Sullivan *et al.* (1995) defined an exaggerated negative orientation regarding harmful stimuli as catastrophic thinking (or catastrophizing). This catastrophic perception may result from negatively perceived past experiences or from threatening information originating from the environment and causing fear and anxiety (Corbière *et al.*, 2011). To manage these

negative emotions, individuals avoid all movement or activity likely to trigger pain, and consequently, anxiety. This inappropriate strategy reduces anxiety in the short term, but with time, it maintains and fuels fear and results in poorer physical condition, increases functional disability, and generates depressive symptoms (Corbière *et al.*, 2011; Vlaeyen *et al.*, 2002; Vlaeyen & Linton, 2000).

In our statistical analyses, given that the main injury site was the back, we decided to combine all MSDs into one. This procedure appeared salient because in recent decades, many studies have been conducted on workers with MSDs. A large proportion of them have focused on back problems as opposed to MSDs involving the upper extremities. Nonetheless, the scientific evidence indicates that a number of prognostic factors and interventions are similar for MSDs involving the back and those involving the upper extremities. In fact,Waddell *et al.* (2003) demonstrated in a systematic review that several factors predicting chronic pain and long-term work disability were similar for different health problems (back problems and other MDS, cardiovascular disease, and mental health problems). As well, in a scoping review, Campbell *et al.* (2007) showed the existence of evidence that the multidisciplinary biopsychosocial approach is as effective for MSDs involving the back as for those involving the upper extremities.

This study has some strengths and limitations. First, it benefited from the existence of a clinical database containing data on a large number of subjects over a long period of time, specifically, three years. The majority of studies in the literature on the determinants of a return to work or not in individuals with an MSD involve short-term follow-up (from three to 12 months). In this study, follow-up was conducted over a three-year period following the end of the intervention. One objection might be that the taking into account of work status over a long period of time (more than 24 months) is subject to the influence of numerous other variables, such as age, precarious work, unemployment rate, and several socioeconomic variables (Vowles *et al.*, 2004). While this potential influence is unquestionable, it probably exists for short-term follow-ups as well.

As shown in the study by Corbière *et al.* (2007), it would have been worthwhile to measure the pain intensity using another type of tool that is more comprehensive and accurate, such as the McGill Pain Questionnaire (Melzack, 1983; Melzack & Katz, 2001). Moreover, pain frequency could also have been evaluated. Had we done so, combined with the measure of pain intensity, we would have obtained a more accurate measure of the pain. It would also have been highly pertinent to systematically measure the pain intensity at the end of the PRÉVICAP program. This was not done because the program was not focused simply on reducing symptoms, but also on reactivating the individual (physically and psychologically). Thus, the program results concern function not pain. In their clinical practice, therefore, all the professionals concentrated on work capacities rather than on pain and did not measure pain intensity at the end of the program because this procedure contradicted the discourse held with the workers.

As the objective was to understand the evolution of pain intensity over time and its relationship to work status, it was considered important to have data common to all the subjects over a similar period of time. This decision therefore limited the number of potential subjects in the analysis to 107 because approximately 50% of the workers whose cases were managed agreed to answer the follow-up questionnaire at one and three years post-intervention and certain

data were missing from the database. Given the observational and retrospective nature of our study, we had no control over the data collected by the clinicians. For various reasons that were not necessarily noted, some clinicians collected certain data diligently while others did not. This is a limitation of the study. However, apart from the age difference observed between the sample population in this study (n=107) and the population of all participants in the program (n=353), the other variables (gender, pathology, number of weeks of work absence) did not point to any differentiation between these groups of workers. It should also be noted that the difference in the mean age in each group (even if statistically significant) remains modest because in the group with complete data, the mean age was 43 years (standard deviation of eight years), while the mean age was 40 years (standard deviation of nine years) in the group with incomplete data.

In this study, each variable was treated individually regardless of the potential influence of the other variables on the main variable. This statistical choice may be debatable, but the aim of the study was not to build a predictive model, but rather to determine profiles of pain intensity evolution in relation to the return to work. The study of profiles for the purpose of identifying groups of workers susceptible to long-term disability is still a recent phenomenon (Boersma & Linton, 2006a;2006b; Corbière *et al.*, 2007; Mngoma *et al.*, 2008) and therefore warrants further investigation. Lastly, the population in this study comprised workers on sick leave due to an MSD and who had completed the PRÉVICAP program. The external validity of the conclusions must be supported by additional studies on the subject and with other populations.

6. CONCLUSION

The objective of this study was to study the relationship between the perception of pain experienced by a worker with an MSD and his work situation following participation in a return-to-work program, a program that has already proven effective (Rivard *et al.*, 2011). The results indicate that the workers whose level of pain intensity decreased over time, regardless of whether it was low or high at the start of the program, had a higher rate of employment than did the workers who saw their pain intensity increase over time. Based on these results, it would appear that the evolution of the perception of pain intensity is related to work status. The pain per se must be recognized, but must also be understood as a complex interaction between a biological change that often cannot be eliminated and a social context that can be improved.

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APPENDIX A: POST-INTERVENTION FOLLOW-UP QUESTIONNAIRE

Hello Mr./Ms. _____,

My name is … and I am calling from PRÉVICAP. I would like to do a follow-up of your condition and ask you a few questions about the program you completed. This should only take about 10 minutes. Would you be willing to participate?

A. Since the end of your treatment in the PRÉVICAP program, would you say that the problem you were treated for:
- ❑ Has improved?
- ❑ Has remained stable?
- ❑ Has gotten worse?

B. Do you currently feel pain because of this same problem?
If yes, on a scale of 0 to 10, what was the average intensity of your pain in the past week?

☐ Average intensity

C. Since the end of your treatment in the PRÉVICAP program, have you been able to reintegrate into your household and leisure activities that you abandoned due to your injury?
- ❑ All of them
- ❑ Most of them
- ❑ A few of them
- ❑ None of them

D. During the past year, did you receive treatments from another health professional for the same problem that was treated in the PRÉVICAP program?

❑ No	❑ Physiotherapy	❑ Physician - medication
❑ Chiropractic	❑ Osteopathy	❑ Physician - surgery
❑ Acupuncture	❑ Physician - injection	❑ Other_____

E. Are you currently working?

☐ Work status

Thank you for your time and please feel free to contact us if you have any questions. Have a good day!