Upper Extremity Injured Workers Stratified by Current Work Status: An Examination of Health Characteristics, Work Limitations and Work Instability

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Abstract

Background: Upper extremity injured workers are an under-studied population. A descriptive comparison of workers with shoulder, elbow and hand injuries reporting to a Canadian Workplace Safety and Insurance Board (WSIB) clinic was undertaken.

Objective: To determine if differences existed between injury groups stratified by current work status.

Methods: All WSIB claimants reporting to our upper extremity clinic between 2003 and 2008 were approached to participate in this descriptive study. 314 working and 146 non-working WSIB claimants completed the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH); Short Form health survey (SF36); Worker’s Limitations Questionnaire and the Work Instability Scale. Various parametric and non-parametric analyses were used to assess significant differences between groups on demographic, work and health related variables.

Results: Hand, followed by the shoulder and elbow were the most common site of injury. Most non-workers listed their current injury as the reason for being off work, and attempted to return to work once since their injury occurrence. Non-workers and a subset of workers at high risk for work loss showed significantly worse mental functioning. Workers identified physical demands as the most frequent injury-related on the job limitation. 60% of current workers were listed as low risk for work loss on the Work Instability Scale.

Conclusions: Poorer mental functioning, being female and sustaining a shoulder injury were risk factors for work instability. Our cohort of injured non-workers were unable to return to work due to their current injury, reinforcing the need to advocate for modified duties, shorter hours and a work environment where stress and injury recurrence is reduced. Future studies examining pre-injury depression as a risk factor for prolonged work absences are warranted.

Keywords: Upper extremity; Forearm injuries; Sick leave; Musculoskeletal diseases; Return to work; Work instability
Introduction

Musculoskeletal diseases are second only to cardiovascular diseases in terms of economic burden to the Canadian health care system. Work related musculoskeletal disorders of the upper extremity are a multi-faceted group of disorders affecting soft-tissue structures extending from the neck to the hand which are brought on and sustained by work. They comprise various clinically defined pathologies such as carpal tunnel syndrome and epicondylitis as well as undefined conditions comprising pain, swelling and/or discomfort of muscles, tendons, or nerves in the upper extremity.

Musculoskeletal disorders and traumatic injuries of the upper extremity accounted for approximately 39% of longterm disability costs, and 40% of all lost time claims over the past 10 years in Ontario workplaces. In 2008, 1.7% of workers in Ontario suffered a lost-time work injury. This translates into 78 256 total lost-time claims and close to C$ 2 million in benefit and administration costs incurred. High incidence and prevalence of upper extremity disorders (UEDs) has been found in particular occupational groups and associated with highly repetitive work involving continuous movements and forceful exertion of the arm or hand. In addition, psychosocial factors such as high job demand, non-work-related stress and personal characteristics such as coping can cause UEDs.

The Workplace Safety and Insurance Board (WSIB), Ontario, Canada, is an organization mandated under the Workplace Safety and Insurance Act to promote health and safety in Ontario workplaces. The vision of the Ontario WSIB is the elimination of all workplace fatalities, injuries and illnesses. In 1998, the WSIB established Specialty Clinics at various academic health sciences centers to help promote this vision. There are now 15 Specialty Clinics across the province of Ontario that provides specialized assessment and treatment for workers with complex injuries including upper and lower extremity injuries, neurological injuries, burns and amputations, psychological trauma and chronic pain, and occupational diseases. Workers are referred to the Specialty Clinics by the WSIB service delivery teams. Requests from community physicians or specialists can be directed through the worker’s case manager.

One Ontario Workplace Safety and Insurance Board survey revealed that two-thirds of workers with an upper extremity work-related disability experienced subsequent injury-related work absences attributed to the original injury. While the purpose behind WSIB clinics is to return patients to productive life and work, significant under-reporting of these disorders to workers’ compensation makes them an under-studied population. This suggests that the losses of productivity and costs to injured workers are on a much larger scale than current estimates suggest. The objective of this descriptive study was to examine demographic, health and work related variables in a cohort of upper extremity injured persons receiving worker’s compensation, stratified by current work status.

Patients and Methods

Participants

Approval for this descriptive study was given by our Institutional Human Ethics Review Board. Patients who are seen in our WSIB clinic are referred because they are in need of advanced assessment, investigations and treatment planning, and/or recommendations regarding return to work capabilities and prognosis. Our clinic is staffed by specialty-specific medical experts, physiotherapists and occupation-
Approximately 100 patients per year are assessed for the first time in our clinic. Most will return for a follow-up visit related to their initial assessment, and a few former patients may be visited again for re-assessment, as directed by the WSIB. In 2003, we began collecting demographic, medical and questionnaire data from all patients upon their initial visit to our clinic. Each WSIB patient is first approached by a research nurse and given informed consent allowing us to collect and store their data in a registry for WSIB research related purposes. Each consenting patient is asked to complete the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH) and the Short Form Health Survey (SF36).8 Patients who were still active at their work-place were defined as “current workers” and asked to additionally complete the Work Limitations Questionnaire (WLQ)9 and the Work Instability Survey (WIS).10

The rest of the patient cohort completed a short questionnaire designed for those currently not working. A more detailed description of these data collection instruments is listed below.

**Measurements: health outcomes and work limitations**

The DASH questionnaire was used to assess physical functions and symptoms of the upper limb. Responses to the individual items are summed, averaged, and transformed to a standardized score of 0–100, with a higher score indicating greater disability.

The SF36 was used to assess physical and mental health. Test items are scored and transformed in an algorithm to norm-based scores with a mean of 50 and a standard deviation of 10. Physical and mental scores range from 0–100, a higher score indicating better health.

The 16-item version of the WLQ was used to assess limitations at work due to injury or associated treatment. The WLQ covers four domains: output demands, mental demands, physical demands and time management demands. Items are scored on a five-point scale, ranging from “none of the time” to “all of the time.” The scores on the individual items are summed, averaged, and transformed to a standardized score of 0–100, with a higher score indicative of more limitations. Examples of questions from the various domains include Time: “work the required number of hours” and “do your work without stopping to take breaks/rests?” Physical: “walk or move around different work locations;” Mental: “concentrate on your work” and “control your temper around people when working;” Output: “work fast enough,”

**TAKE-HOME MESSAGE**

- Poorer mental functioning, being female and sustaining a shoulder injury were found to be risk factors for work instability.
- Non-workers showed significantly worse mental functioning, and attempted to return to work at least once after their injury occurrence.
- Workers were significantly more likely to list injury-related physical factors as the cause for their limitations at work.
- Research examining pre-existing depressive states as a risk factor for work-related injury are needed.
- Employers need to consider modified work duties and shorter working hours to help prevent injury recurrence and future workplace absences.

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“handle the workload” and “do your work without making mistakes.”

Concentrating on the mismatch between functional ability and the demands of work, the WIS was developed as a screening tool for potential work loss. This survey has 23 items (statements about the impact of the disease on working), derived from the patient interviews, each of which is affirmed as “true” or “false.” The survey is scored by summing the 23 items, giving a range of 0–23, enabling subjects to be categorized into three groups corresponding to low, medium and high risk.

Finally, for those patients not currently working, a short three-part questionnaire was administered examining modified work duties, reasons for not working and attempts at return to work.

Statistical analyses

Univariate statistics—means, standard deviations, frequency counts, proportions—were used to describe patients for the total cohort. A residuals analysis was performed to determine whether the data met the assumptions of parametric tests (i.e., normally distributed with equal variances). Continuous variables with normal distribution were presented as mean±SD; non-normal variables were reported as median (interquartile range [IQR]).

Differences in age, gender, injury type and number of bilateral injuries (injuries to both sides) between workers and non-workers were compared using χ² and independent samples Student’s t tests. Independent samples Student’s t test were also used to compare DASH and SF36 scores between groups. A one-way ANOVA was used to examine significant differences between the four WLQ domains for the currently employed workers. All statistical analyses were performed with SPSS 17.0 (SPSS Inc, Chicago, IL, USA). A p value <0.05 was considered statistically significant.

Results

By the end of 2008, 460 WSIB specialty clinic patients had given their consent to allow data collection for research purposes. Forty-seven percent of these presented with hand, 33% with shoulder and 20% with elbow injuries. Demographic descriptions of the cohort stratified by their work status, i.e., workers and non-workers, are listed in Table 1. Table 2 describes differences in DASH and SF36 scores between groups. Significant differences were found between groups on the mental component score of the SF36, with the non-working groups scoring lower indicating worse mental functioning (p=0.03). Significant differences were also noted when comparing the proportions of injury types and gender distribution between groups (Ta-

Table 1a: Cohort Demographics—workers vs non-workers

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Workers (n=314)</th>
<th>Non-workers (n=146)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean±SD)</td>
<td>46±9.8</td>
<td>45±10.6</td>
<td>0.40</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>174</td>
<td>63</td>
<td>0.01</td>
</tr>
<tr>
<td>Female</td>
<td>140</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>Bilateral Injury</td>
<td>13</td>
<td>13</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Table 1b: Injury types*—workers vs non-workers

<table>
<thead>
<tr>
<th>Type</th>
<th>Workers (%)</th>
<th>Non-workers (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>40</td>
<td>61</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Elbow</td>
<td>24</td>
<td>10</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Shoulder</td>
<td>36</td>
<td>29</td>
<td>0.07</td>
</tr>
</tbody>
</table>

*Entire cohort: 47% hand, 33% shoulder, 20% elbow
For those patients who were not currently working, 48% reported that they were offered light or modified duties while 31% reported that they were offered reduced hours to help them return to work. Those individuals that attempted to return to work since their injury were asked how many times; 52% reported one time, 34% reported two times, 10% reported three times, 2% reported four times and another 2% reported five or more times. Responses given to the main reasons listed for not working are shown in Table 3. “Other” reasons given included “looking for a more suitable job,” “no light or modified duties to be done,” “not strong enough,” “too much pain in arm,” “laid off for poor attendance,” “can no longer lift” and “hard to get work with an injury.”

Table 4 depicts the average scores on the four domains of the WLQ for those individuals who were currently working; the higher scores indicating higher limitations. Results of ANOVA analysis revealed that scores on the physical domain were significantly higher and scores on the mental domain were significantly lower than the other three domains. Examples of questions on the physical WLQ domain include investigations into ability to walk or move around different work locations; lifting, carrying or moving objects weighing more than 10 pounds; sitting, standing or staying in one position for longer than 15 minutes; repetitive motions while working, bending, twisting or reaching and using hand-held tools or equipment (including the phone, a pen, keyboard, mouse, drill, hairdryer, and/or sander).

The term “work instability” relates to any mismatch between functional (and/or cognitive) (in) capacity and work demands and its potential impact on efficiency and/or productivity and ultimately on job retention/security if not addressed. For the employed workers that answered the WIS, 60% scored in the low risk, 25% on the medium risk and 15% on the high risk scale for work loss. The people who scored on the high risk scale were examined in more detail. The mean age of this subset was 52 years, 62% were female and 24% had a bilateral injury. Most of

![Table 2: SF36 and DASH scores—workers vs non-workers](image)

<table>
<thead>
<tr>
<th>Survey</th>
<th>Score (Mean±SD)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workers</td>
<td>Non-workers</td>
</tr>
<tr>
<td>DASH</td>
<td>49.6±18.5</td>
<td>52.5±19.8</td>
</tr>
<tr>
<td>SF36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>35.7±8.1</td>
<td>34.9±7.4</td>
</tr>
<tr>
<td>Mental</td>
<td>42.4±12.5</td>
<td>38.4±14.2</td>
</tr>
</tbody>
</table>

![Table 3: Reasons for not working by rank order](image)

<table>
<thead>
<tr>
<th>What is the main reason you are not working?</th>
<th>Percent Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am unable to work because of my current problem</td>
<td>64</td>
</tr>
<tr>
<td>My employer/supervisor responded negatively to my injury</td>
<td>12</td>
</tr>
<tr>
<td>My previous job is not available</td>
<td>9</td>
</tr>
<tr>
<td>I do not feel mentally and/or emotionally able to return to my previous job</td>
<td>3</td>
</tr>
<tr>
<td>My co-workers responded negatively to my injury</td>
<td>1.5</td>
</tr>
<tr>
<td>I quit my previous job</td>
<td>1.5</td>
</tr>
<tr>
<td>I am being retrained</td>
<td>1.5</td>
</tr>
<tr>
<td>I have retired</td>
<td>1.5</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
</tbody>
</table>
this group (49%) sustained shoulder injuries while 32% sustained hand and 19% sustained elbow injuries. In addition, we found that 90% or more of this subset answered “yes” to the following on the WIS: “When I’m feeling tired all the time work’s a grind;” “I have pain or stiffness all the time at work;” “I don’t have the stamina to work like I used to;” “It’s very frustrating because I can’t always do things at work;” “Sometimes I can’t face being at work all day;” “I’ve got to watch how much I do certain things at work;” “I have to allow myself extra time to do some jobs;” “I’d like another job but I am restricted as to what I can do;” “I am very worried about my ability to keep working.”

When the high risk WIS groups’ WLQ scores were compared to those who scored medium or low on the WIS risk scale, results revealed significantly higher scores on the time, mental and output domains (p<0.005), indicating greater limitations in these areas. In addition, significantly lower scores indicating worse mental functioning were found on the mental health component of the SF36 for the high risk WIS group (p<0.005).

Discussion
Musculoskeletal disorders, in addition to being a leading cause of disability, are a huge economic burden to the health care system. Most workplace injuries are to the back and upper extremities. Despite this fact, upper extremity injured workers are a relatively under-studied population. This report focused on a cohort of workers with shoulder, elbow and hand injuries that reported to a WSIB clinic in south-eastern Ontario, Canada.

The majority of the patients in our cohort who were currently off work attempted to return to work since their injury. Most, however, made the attempt to return to work only once. This finding around return to work is similar to those reported in the recent literature. One study examining costs and outcomes beyond first return to work in upper extremity injured workers found that while 80% of workers returned to work at least once, two-thirds experienced a subsequent injury-related work absence due to their original injury.6 Another recent study of musculoskeletal injured workers, although not citing injury recurrence as a cause, reported a substantial rate of recurrence of work absence in the first six months of initial return to work.11

Our cohort as a whole mainly sustained hand injuries. When compared with elbow and shoulder injuries, this is not an uncommon finding. Recent data from the WSIB reported the breakdown of upper extremity injuries as follows: 54% were hand injuries (including fingers), 20% were classified as arms injuries, 18% as wrist and the other 7% were “not elsewhere classified.” The “upper extremity” body part category did not include the back or the shoulder. Shoulder injuries fell under the “trunk” category, and accounted for 48% of all trunk injuries.2 This same rank order of hand, shoulder and elbow continued when we stratified our sample by workers and non-workers. This was not the case, however, when we examined the

<table>
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<th>Table 4: Workers Limitations Questionnaire (WLQ)</th>
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<tbody>
<tr>
<td>Domain</td>
</tr>
<tr>
<td>Output demands (Mean±SD)</td>
</tr>
<tr>
<td>Time demand (Mean±SD)</td>
</tr>
<tr>
<td>Mental/interpersonal demand (Median (IQR))</td>
</tr>
<tr>
<td>Physical demands (Median (IQR))</td>
</tr>
</tbody>
</table>
subset of workers at highest risk for work loss; half these workers suffered from shoulder injuries, followed by hand and elbow injuries. Workers suffering with shoulder injuries may require greater return to work accommodations in terms of work hours and modified duties.

When the domains of work limitations due to the injury were compared to one another within the current workers cohort, results showed significantly poorer physical limitation scores and significantly better mental limitation scores. It is interesting to note that these findings were reversed when examining only those workers that were at high risk for work loss according to the WIS. This subset of workers reported having significantly greater difficulties on mental, output and time-related but not physical work tasks. Their poorer mental functioning was further confirmed by their significantly worse SF36 mental functioning scores, indicating that mental more than physical health may be responsible for work instability.

This finding highlights the impact that poor mental health can have on workers with upper extremity injuries. Much of the current research in the area of mental health and work-related disability has focused on the effects of depression. Findings point to depression as a factor involved in prolonged work disability and longer duration of wage replacement benefits following work injury. It has been reported that individuals with pain-related musculoskeletal conditions who are depressed have sick leave durations that are twice as long as individuals with musculoskeletal conditions who are not depressed.\textsuperscript{12-16} It is not known, however, if depression in these individuals preceded the injury or was an effect of being work disabled. A pre-existing depressive state may be a risk factor for work-related injury claims. Studies clarifying this possibility are needed. For this reason, we are now collecting information relating to chronic, pre-injury depression in our WSIB clinics.

Several limitations in this study need to be acknowledged. Participants may have misinterpreted items on any of the questionnaires they were required to complete, resulting in inaccurate reporting. Also, participants in this study were not randomly selected but rather claimants for worker’s compensation. As such, the reporting of their injury severity may differ from those injured workers not receiving compensation, resulting in sample bias. The generalizability (external validity) of our findings to other populations of upper-extremity injured workers is unknown. This is a descriptive study and therefore we can only report on associations between variables, not causality. Finally, the study results should not be interpreted as evidence for or against the effectiveness of WSIB Specialty Clinics. Better evidence for or against efficacy would come from high-quality randomized clinical trials.

Despite these limitations, our findings point to a population of injured workers that requires a health care team to carefully assess the worker’s capabilities and to identify patients with depression and other mental comorbidities. Health workers need to play an active role in advising the patient on how to prevent re-injury at their workplace. In addition, since our cohort of injured non-workers reported being unable to return to work due to their current injury, all upper-extremity injured workers should be considered for modified work accommodations and shorter working hours when returning for the first time, to reduce the risk of recurring injury and further workplace absence. Lastly, psychological care for non-workers and current workers who appear to be more susceptible to work loss is warranted. Medical treatment recommendations
should take into account other co-morbidities such as psychological disorders as well the primary musculoskeletal condition. There is clearly a need to examine, address and promote a work environment for the worker suffering an upper extremity injury where stress and other obstacles preventing a successful return to work are removed.

Acknowledgements
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Conflicts of Interest: None declared.

References