
Technical Report Number 40-12-2015
February 2015
SUMMARY ONLY

Naomi Anderson, MPH
Darrin Adams, BS
David Bonauto, MD, MPH
Ninica Howard, MSc, CPE
Barbara Silverstein, PhD, MPH
Safety and Health Assessment and Research for Prevention (SHARP)
Washington State Department of Labor and Industries

SHARP Program
P.O. Box 44330
Olympia, WA 98504-4330
www.lni.wa.gov/Safety/Research

Corresponding author: Ninica Howard
Telephone: (360) 902-5657
Fax: (360) 902-5672
E-Mail: Ninica.howard@lni.wa.gov

Key Words: work-related musculoskeletal disorders, sciatica, carpal tunnel syndrome, epicondylitis, rotator cuff syndrome, bursitis, tendonitis, tenosynovitis, workers compensation

Acknowledgment: The authors would like to thank Renae Knowles for her very great assistance with this report, as well as Jia-Hua Lin, Randy Clark, and Alysa Haas.

Supported in part by CDC/NIOSH Cooperative Agreement U60 OH008487.
REPORT SUMMARY

OBJECTIVES
We report the frequency, incidence rate (number of new claims per 10,000 full-time equivalent employees FTEs, CIR), severity rate (number of lost days per 10,000 FTEs, SR), cost, lost time and industry group distribution of work-related musculoskeletal disorders (WMSDs) in Washington State in order to monitor and help focus prevention efforts by business, labor and government.

METHODS
In the current report we examined State Fund and Self-Insured workers’ compensation claims (four or more lost workdays) for general and selected shoulder, elbow, hand/wrist, back and knee disorders occurring between 2002-2010. We used a prevention index (PI) to rank industries by taking the average rank by incidence rate and rank by number of claims. We used the North American Industrial Classification System (NAICS) to code industry groups for national comparison purposes; and we used the National Occupational Research Agenda (NORA) Sector grouping method (which groups the 20 NAICS sectors into 10 sector groups for research and prevention efforts; Appendix A).

The focus was on non-traumatic soft-tissue musculoskeletal disorders. These musculoskeletal disorders, when caused or aggravated by work activities (for example, exposures to frequent or heavy manual handling, awkward postures, forceful or repetitive exertions) are referred to as work-related MSDs or WMSDs.

RESULTS
Between 2002 and 2010 there were 409,711 compensable claims and 176,033 of them (43%) were for work-related non-traumatic musculoskeletal disorders of the back, upper extremity and knee (WMSDs) in Washington State (see following table, Table 3 in the full report).

JZ, a 42-year-old truck driver with lumbar back strain: “I can’t lift my grandbaby. Grandpa’s got to sit in the chair and you can bring him to me. And I’m only 42, I shouldn’t be feeling this way. I live with pain every day. Makes me a little bitter and a little angry. I’ve seen how easily you can lose a lot of stuff by an injury. I’ve lost so much. A decent wage, I probably lost an industry.”

<table>
<thead>
<tr>
<th></th>
<th>All Compensable Claims</th>
<th>Non-Traumatic Soft-Tissue Disorders (WMSDs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Compensable Claims (SF+SI)</td>
<td>409,711</td>
<td>176,033</td>
</tr>
<tr>
<td>% of ALL Compensable Claims</td>
<td>100.0%</td>
<td>43.0%</td>
</tr>
<tr>
<td>Combined SF+SI Indemnity Costs ($Millions)</td>
<td>$8,223.5</td>
<td>$3,869.2</td>
</tr>
<tr>
<td>State Fund Medical Costs ($Millions)</td>
<td>$4,306.5</td>
<td>$1,802.8</td>
</tr>
<tr>
<td>Average # Claims per Year (SF+SI)</td>
<td>45,523</td>
<td>19,559</td>
</tr>
<tr>
<td>Percent Female (SF+SI)</td>
<td>35.2%</td>
<td>40.1%</td>
</tr>
<tr>
<td>Median Age(SF+SI)</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>Median BMI (SF)</td>
<td>27.5</td>
<td>27.9</td>
</tr>
<tr>
<td>Median Tenure Months (SF)</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Claims Rate per 10,000 FTE (SF+SI)</td>
<td>209.4</td>
<td>90</td>
</tr>
<tr>
<td>SF Severity (TL days per 10,000 FTE)</td>
<td>37,909.0</td>
<td>18,397.5</td>
</tr>
<tr>
<td>SF Average TL Days per Claim</td>
<td>231.9</td>
<td>266.5</td>
</tr>
<tr>
<td>SF Median TL Days per Claim</td>
<td>43</td>
<td>56</td>
</tr>
<tr>
<td>SF Average Total Direct Costs per Claim</td>
<td>$40,800</td>
<td>$44,687</td>
</tr>
<tr>
<td>SF Median Total Direct Costs per Claim</td>
<td>$8,636</td>
<td>$11,183</td>
</tr>
</tbody>
</table>

SF: State Fund, SI: Self Insured

BMI = weight in kilograms/height in meters²

*Hgt / Wt were available for 91.4% of SF Comp

**Tenure was available for 76.6% of SF Comp

The combined costs were also about half of all compensable claims costs. Overall, WMSDs accounted for approximately 40% of costs (see figure to the right, Figure 2 in the full report), whereas the average and median costs for all compensable claims were roughly $40,800 and $8,636, the costs were higher for WMSDs ($44,687 and $11,183, respectively).

Median time loss days averaged 43 for all compensable claims and 56 for WMSDs. By body area (Tables 4, 7-11), claims for “Back” were the most common, with 29,990 compensable claims accounting for 19.5% of all compensable claims and median costs were highest for the shoulder ($28,228) and lowest for the back ($6,032) (Table 4).

In terms of specific diagnoses, only State Fund (SF) data were available (Table 5). The SF carpal tunnel syndrome (CTS) incidence rate (IR) was 6.4 per 10,000 FTEs and the Severity
Rate (SR) was 2,654 time loss days per 10,000 FTE. The highest incidence rates were in Construction (Table 15). The CIR for hand/wrist tendonitis was 3.4 and SR was 1,457 per 10,000 FTE respectively, whereas compensable knee bursitis and sciatica had considerably lower rates (CIR= 0.2 and 2.3 per 10,000 FTEs, respectively) (Table 5).

Based on Industry, the Healthcare and Social Assistance sector was first on the PI with a compensable CIR of 108.4 per 10,000 FTEs and a severity rate (SR) of 12,085 lost workdays per 10,000 FTE (Table 6). Transportation and Utilities was second with a CIR of 174.5 and SR of 18,545 lost work days per 10,000 FTEs.

There was a significant decrease in total compensable claims rate primarily between 2002-2007 and then a leveling off in every sector (Figures 1 and 1a). The slope continued to decline for all compensable claims but flattened out for WMSD claims from 2007 forward (Figures 1 and 1A). Overall, for State Fund compensable claims, WMSD claims decreased by 6.26% by year (p<0.0001), which was a greater or faster decrease than that of non-WMSD claims which were decreasing by approximately 2.25% by year (p<0.0001) during the report period.

The pattern of significant decrease is also true for the different body areas covered in this report (Figures 3-8).

We looked at several specific diagnostic codes (ICD-9) for WMSDs in the State Fund (Tables 12-17) and found:

For rotator cuff syndrome (Table 12), there were 12,056 compensable claims in the State Fund with:
- An average CIR of 8.6 and a SR of 3,436 days per 10,000 FTEs.
  - The CIR for rotator cuff syndrome has stayed relatively flat over the report period (Figure 9).

For epicondylitis (Table 13), there were 3,057 compensable claims in the State Fund with:
- An average CIR of 2.2 and a SR of 781 days per 10,000 FTEs.
  - The CIR for epicondylitis decreased slightly from 2002-2006, and has since flattened (Figure 10).
- Average compensable claims cost of $55,121 per claim (Table 5).
For **hand/wrist tendonitis** (Table 14), there were 6,562 compensable claims in the State Fund over the report period with:

- An average CIR of 4.7 and a SR of 1,480 per 10,000 FTEs.
  - The overall CIR decreased significantly over the report period, but began to flatten between 2009 and 2010 (Figure 11).
- Average cost of $30,930 per compensable claim.

For **carpal tunnel syndrome** (Table 15), there were 12,420 compensable claims in the State Fund over the report period with a CIR of 8.9 and a SR of 2,704 days per 10,000 FTEs with:

- Average direct cost of $49,481 per claim (Table 5).
- Average time loss was 321 days.
- Among State Fund compensable claims, CTS incidence decreased slightly since 2006 except for manufacturing which decreased more than half since 2004 (Figure 12).

For **sciatica** (Table 16), there were 4,517 compensable claims in the State Fund over the report period with a CIR of 3.2 and a severity rate (SR) of 1,876 days per 10,000 FTEs.

- Sciatica claims were extremely costly: $319,147,531 dollars and 2,620,692 lost work days.
- The overall CIR for sciatica (Figure 13) has decreased slightly over the report period.
  - The CIR for Construction has decreased by half since 2002; the Construction CIR overall for sciatica is more than twice the state rate (Table 16).

For **bursitis of the knee** (Table 17), there were 480 compensable claims in the State Fund over the report period with a CIR of 0.3 and a severity rate (SR) of 99 days per 10,000 FTEs.

- The CIR for knee bursitis (Figure 14) in Construction decreased between 2003-2006 and flattened thereafter; the Construction CIR overall for knee bursitis is 4 times the state rate (Table 17).

We used the Prevention Index (PI) to identify industries with the greatest impact of WMSDs. Industries are listed in rank order by the number of claims and by the rate of claims. The PI is the average of the two ranks for each industry. An industry therefore is high on the PI if it has a relatively high number of claims and a relatively high CIR.
We calculated the PI for industry sectors and also calculated a rate ratio for each industry sector (see below) by comparing the CIR for each industry with the overall state CIR for all WMSD claims (Table 6) and by body part (Tables 7-11) and by specific condition (Tables 12-17). A rate ratio of 3, for example, means that the rate for that industry is 3 times the overall state rate. Construction and Transportation & Utilities had the highest rate ratios.

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>Overall Rate Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>1.9</td>
</tr>
<tr>
<td>Transportation &amp; Utilities</td>
<td>1.9</td>
</tr>
<tr>
<td>Health Care</td>
<td>1.2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.2</td>
</tr>
<tr>
<td>Trade</td>
<td>1.1</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.7</td>
</tr>
<tr>
<td>Services</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Overall, the Top 10 industry groups for all WMSD claims (Table 6) were:

1. Scheduled Air Transportation (NAICS 4811)
2. Foundation, Structure, & Bldg. Exterior Contractors (NAICS 2381)
4. Couriers & Express Delivery Svcs. (NAICS 4921)
5. Nursing Care Facilities (NAICS 6231)
6. General Medical & Surgical Hospitals (NAICS 6221)
7. Bldg. Finishing Contractors (NAICS 2383)
8. General Freight Trucking (NAICS 4841)
9. Grocery Stores (NAICS 4451)

Workers in these industry groups warrant priority focus in prevention and intervention efforts to reduce these injuries, as they are ranked highly by PI across several body regions and diagnoses.

**Conclusions** Work-related musculoskeletal disorders continue to be a large and costly problem in Washington State. The incidence rates for most WMSDs are decreasing overall and in most industry sectors; in some cases, the rate is relatively flat. The highest risks are in industries characterized by manual handling and forceful repetitive exertions. The burdens of WMSDs are underestimated because there are evidences of under-reporting of disorders in the literature, and the indirect costs to the employer, employee and society are not included.
6.0 GLOSSARY

6.1 KEY TERMS

**Body Mass Index (BMI)**  
\[
\text{[Weight (lbs) / height (in)}^2] \times 703
\]

**Full-Time Equivalent (FTE):** full-time employees work 2,000 hours per year (40 hours per week for 50 weeks per year).

**Claims Incidence Rate (CIR):** number of new claims per 10,000 full-time equivalent (FTE) workers per year.

**NAICS:** North American Industrial Classification System.

**Direct Workers' Compensation costs:** Financial losses directly associated with an injury or illness, such as costs of time-loss compensation, medical expenses and legal costs. Claim costs reported here reflect actual totals for closed claims. For State Fund claims that were not closed, costs reflect actual totals to this date plus the additional case reserve as estimated by agency staff. Costs are expected to develop further for the most recent years.

**Prevention Index (PI):** The average of the two ranks for the specific industry.  
\[
\text{PI} = \frac{\text{Frequency Rank} + \text{Incidence Rank}}{2}
\]

**Relative Risk or Rate Ratio (RR):** Incidence rate of specific industry divided by incidence rate for all industries. Relative risk of more than 1 indicates risk in that industry is more than for all industries combined.

**Severity Rate (SR):** number of lost days per 10,000 full-time equivalent (FTE) workers per year.
6.2 Specific Conditions

Carpal tunnel syndrome (CTS) is the compression of the median nerve at the wrist, due to ischemia or inflammation. CTS is characterized by numbness, tingling, or pain in the median nerve distribution of the hand (first 3 ½ fingers), frequently worse symptoms at night. Work-related CTS has been associated with high repetition, force, awkward wrist postures and segmental vibration (Bernard, 1997; Viikari-Juntura and Silverstein, 1999). A recent study by Ettema (2006) suggested that shear forces related to rapid or forceful finger motions cause tendon scarring in the carpal tunnel. Melchior (2006) reported increased risk with wrist flexion of more than two hours per day in women.

Epicondylitis is an inflammation of the tendon at the elbow (lateral epicondylitis or tennis elbow is most common).

Epicondylitis is characterized by pain during resisted maneuvers that load the tendons and by tenderness on tendon palpation.

Repetitive forceful postures such as twisting or pronation of the forearm combined with extension of the wrist while gripping have been associated with epicondylitis.
Rotator cuff syndrome involves inflammation, degeneration and tear of the tendons around the shoulder (with the supraspinatus tendon most frequently involved). Pain with certain motions is common, particularly against resistance. Tearing usually results in weakness. Work-related shoulder disorders have generally been attributed to high static or repetitive loads on the shoulder girdle, particularly in combination with abduction, rotation or flexion (Bernard, 1997; Melchior et al., 2006).

Sciatic pain is manifested as radiating low back pain that goes below the knee. This very sensitive (95%) indicator of lumbar disc herniation (Deyo, 1992) has been associated with manually handling heavy loads.

Hand/Wrist Tendonitis is may involve one or more tendons that run through the wrist and is characterized by swelling, inflammation or irritation of the involved tendons. Hand/wrist tendonitis may develop due to repetitive wrist motions or prolonged, awkward postures. Symptoms may include an ache, stiffness, tenderness and pain especially when the joint is moved.

Knee Bursitis is the inflammation of one or more bursae, fluid-filled sacs that reduce friction and act as a cushion between bone and tendons. Knee bursitis may present itself as tenderness, swelling, pain, limited joint movement or stiffness.

Each of these specific conditions has also been associated with an acute traumatic onset (e.g., falls).