

Work-Related Musculoskeletal Disorders of the Back, Upper Extremity, and Knee in Washington State, 2002-2010.

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SUMMARY



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WORK-RELATED MUSCULOSKELETAL DISORDERS OF THE BACK, UPPER EXTREMITY AND KNEE IN WASHINGTON STATE, 2002-2010.

REPORT SUMMARY¹

Objectives

We report the frequency, claims 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

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."

of work-related musculoskeletal disorders (WMSDs) in Washington State in order to monitor and help focus prevention efforts by business, labor and government. WMSDs continue to represent a significant proportion of workers' compensation costs, and these data suggest that they should be a high priority for injury prevention in Washington State.

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 the Prevention Index (PI) to rank industries by taking the average of the ranking by incidence rate and the ranking 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

¹ Please note that if you are citing data in this report summary, that Table and Figure numbers are different in the full report, available at: <http://www.lni.wa.gov/Safety/Research/Pubs/>. A glossary defining key terms and specific conditions is included at the end of this report summary. For more information on how SHARP is working to reduce WMSDs, please visit: <http://www.lni.wa.gov/Safety/Research/Wmsd/Default.asp>.

Occupational Research Agenda (NORA) Sector grouping method (which groups the 20 NAICS sectors into 10 sector groups for research and prevention efforts).

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 - Overall & Costs

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 (shoulder, elbow, hand/wrist) and knee (WMSDs) in Washington State (Table 1). Overall, WMSDs accounted for approximately 40% of costs (Figure 1), 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, Table 1).

Table 1. Washington State Compensable Claims. All Claims & Non-Traumatic Musculoskeletal Disorders (WMSDs) of the Back, Upper Extremity & Knee, 2002-2010.

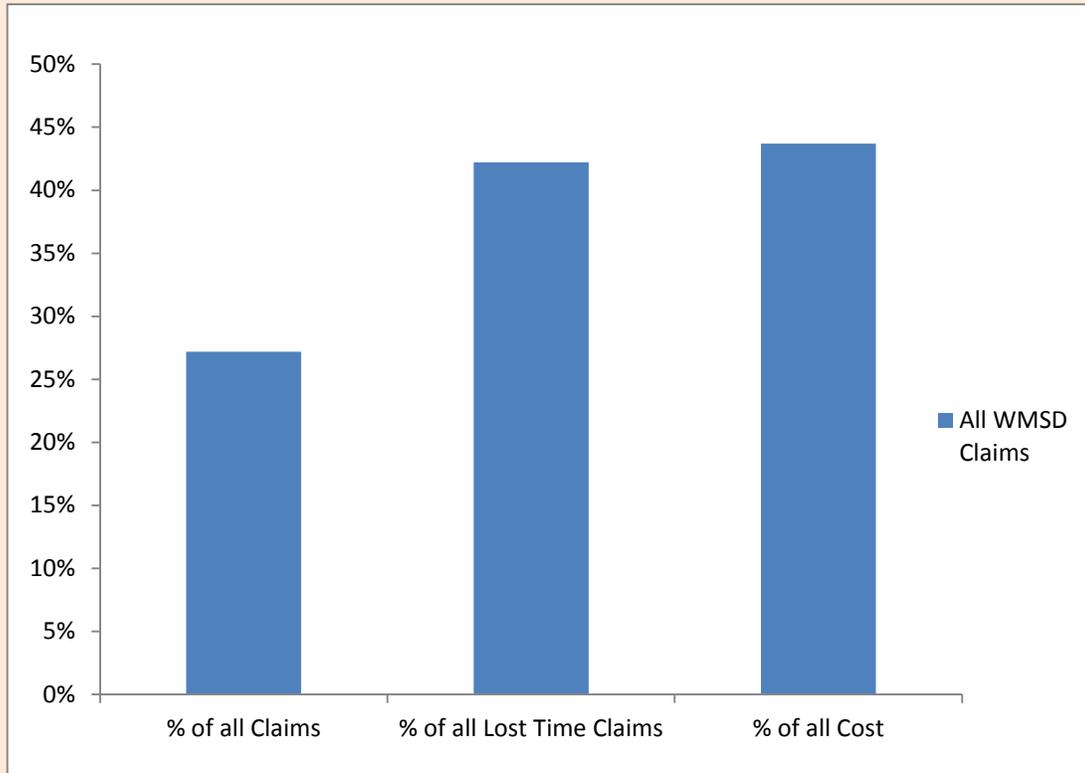
	All Compensable Claims	Non-Traumatic Soft-Tissue Disorders (WMSDs)
Total Compensable Claims (SF+SI)	409,711	176,033
% of ALL Compensable Claims	100.0%	43.0%
Combined SF+SI Indemnity Costs (\$Millions)	\$8,223.5	\$3,869.2
State Fund Medical Costs (\$Millions)	\$4,306.5	\$1,802.8
Average # Claims per Year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

SF: State Fund, SI: Self Insured, TL = Time Loss

*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 Compensable

Figure 1. State Fund WMSD claims, 2002-2010.



Change in Compensable Claims Rate

There was a significant decrease in the total compensable claims rate primarily between 2002-2007 and then a leveling off in every sector (Figures 2). The slope continued to decline for all compensable claims but flattened out for WMSD claims from 2007 forward (Figure 2a). 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 the report.

Figure 2. All Claims - Washington Compensable Claims Rates, by NORA Sector, 2002-2010.

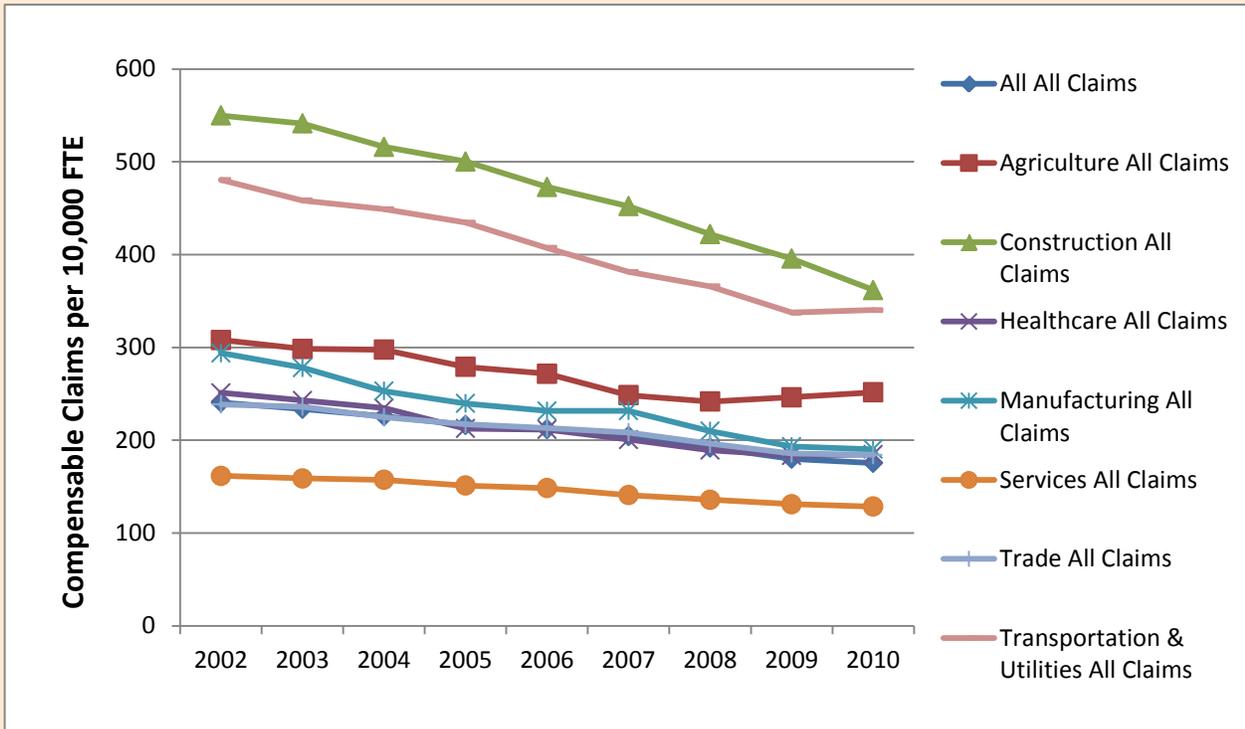
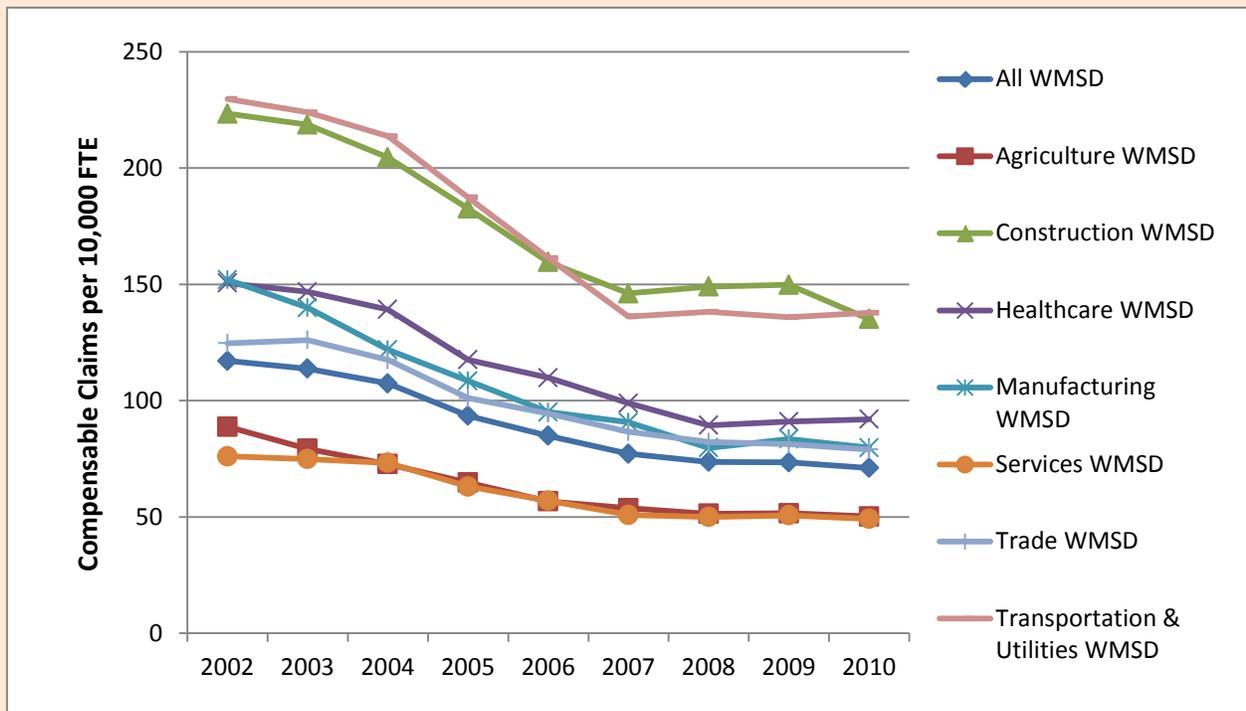


Figure 2a. WMSD Claims - Washington Compensable Claims Rates, by NORA Sector, 2002-2010.



Industries with the Highest Risk of WMSDs

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 (claim and rate) 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. By industry sector (Table 2), the Healthcare and Social Assistance sector was ranked highest by PI, with Transportation and Utilities second.

We calculated the PI for industry sectors and also calculated a rate ratio for each industry sector (Table 2) by comparing the CIR for each industry with the overall state CIR for all WMSD claims. 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 2). The Construction sector also had the highest severity rate ratio (Table 2). The top 25 industry groups by PI are presented in Table 3.

Table 2. Washington State All Compensable WMSD Claims: Industry Sectors by Prevention Index, 2002-2010.

NORA Sector	Number of Industries in Sector	Over-all Rate Rank	Over-all Count Rank	Over-all Claims Rate Ratio	Overall Severity Rate Ratio
Health Care & Social Assistance	18	3	4	1.2	0.9
Transportation & Utilities	30	1	7	1.9	1.4
Construction	10	2	6	1.9	4
Trade	46	5	3	1.1	1
Manufacturing	84	4	5	1.2	0.9
Services	95	8	2	0.7	0.6
Agriculture	18	7	8	0.7	1

Rate: Incidence rate per 10,000 FTEs

Severity rate: time loss days per 10,000 FTEs

Prevention Index:(rate rank + count rank)/2

Table 3. Top 25: Washington State All Compensable WMSD Claims: Industry Groups by Prevention Index, 2002-2010.

NORA Sector Code	NAICS & Industry Description (306 Industries Ranked)	Overall Rate Rank	Overall Count Rank	Overall Rate Ratio	Overall Severity Rate Ratio	Overall PI Rank
U	4811 Scheduled Air Transportation	2	19	3.6	0.4	1
C	2381 Foundation, Structure, & Building Exterior Contractors	11	11	2.4	4.9	2
C	2382 Building Equipment Contractors	17	7	2.2	4.9	3
U	4921 Couriers & Express Delivery Services	4	21	3	0.3	4
H	6231 Nursing Care Facilities	13	13	2.4	2.7	5
H	6221 General Medical & Surgical Hospitals	28	1	1.8	0.1	6
C	2383 Building Finishing Contractors	18	12	2.1	4.6	7.5
U	4841 General Freight Trucking	14	16	2.3	2.6	7.5
T	4451 Grocery Stores	26	5	1.9	0.7	9.5
C	2361 Residential Building Construction	21	10	1.9	3.9	9.5
T	4521 Department Stores	30	6	1.8	0.1	11
S	9211 Executive, Legislative, & Other General Government Support	37	2	1.7	0.3	12.5
S	5621 Waste Collection	5	34	3	1.8	12.5
U	4842 Specialized Freight Trucking	8	33	2.6	3.7	14
S	5617 Services to Buildings & Dwellings	34	9	1.8	2.5	15
H	6219 Other Ambulatory Health Care Services	7	44	2.6	0.9	16
H	6233 Community Care Facilities for the Elderly	31	24	1.8	2.6	17.5
C	389 Other Specialty Trade Contractors	35	20	1.8	3.7	17.5
T	4244 Grocery & Related Product Merchant Wholesalers	48	8	1.6	1.2	19
H	6232 Residential Mental Retardation, Mental Health & Substance Abuse Facilities	16	40.5	2.2	2.6	20
T	4441 Building Material & Supplies Dealers	52	18	1.6	1.2	21.5
T	4529 Other General Merchandise Stores	47	23	1.6	0.5	21.5
M	3211 Sawmills & Wood Preservation	23	55	1.9	2.3	23
M	3221 Pulp, Paper, & Paperboard Mills	44	39	1.6	0.4	24.5
U	4852 Interurban & Rural Bus Transportation	3	80	3.2	2	24.5
M	3364 Aerospace Product & Parts Manufacturing	84	3	1.3	0.1	30
M	3161 Leather & Hide Tanning & Finishing	1	293	7.6	22.7	137

This table also includes those industry groups ranked in the top 3 in count or rate (grey shade) that did not make the Top 25 overall

NORA Sector Code Key: Agriculture, Forestry & Fishing (A), Construction (C), Healthcare & Social Assistance (H), Manufacturing (M), Services (S), Transportation, Warehousing & Utilities (U), Wholesale and Retail Trade (T)

NAICS = North American Industry Classification System

Rate: Incidence rate per 10,000 FTE; Rate Ratio: the industry group rate divided by the overall average rate

Severity Rate: time loss days per 10,000 FTE

Prevention Index: (rate rank + count rank) / 2

By Body Area

By body area (Table 4), claims for the back were the most common, with 29,990 compensable claims accounting for 19.5% of all compensable claims. Median costs were highest for the shoulder (\$28,228) and lowest for the back (\$6,032) (Table 4). Overall, claims incidence rates (CIRs) were decreasing, though this varied between body regions, with back claims having the greatest average decrease by year (Figure 3), and others, such as shoulder, decreasing very little (Figure 4).

Table 4. Washington State Workers Compensation Compensable Claims. Work-related Musculoskeletal Disorders (WMSDs) by Body Area, 2002 - 2010.

	Shoulder	Elbow	Hand / Wrist	Back	Knee
Total Compensable Claims (SF+SI)	29,046	10,407	29,990	79,834	19,728
% of ALL Compensable Claims	7.1%	2.5%	7.3%	19.5%	4.8%
Combined SF+SI Indemnity Costs (\$Millions)	\$869.7	\$299.8	\$633.9	\$1,738.2	\$416.7
State Fund Medical Costs (\$Millions)	\$416.6	\$174.5	\$304.6	\$868.4	\$204.2
Average # Claims per Year (SF+SI)	3,227	1,156	3,332	8,870	2,192
Percent Female (SF+SI)	38.5%	45.0%	56.1%	35.7%	28.0%
Median Age(SF+SI)	45	43	45	40	45
Median BMI (SF)*	28	27.6	28.2	27.4	29
Median Tenure Months (SF)**	29.3	29.3	29.8	28.5	30.3
Claims Rate per 10,000 FTE (SF+SI)	14.8	5.3	15.3	40.8	10.1
SF Severity (TL days per 10,000 FTE)	4,187.4	1,948.2	3,554.5	8,834.5	1,731.9
SF Average TL Days per Claim	354.7	354.2	281.4	263.3	226.3
SF Media TL Days per Claim	129	116	79	35	56
SF Average Total Direct Costs per Claim	\$60,298	\$53,589	\$43,164	\$44,220	\$42,655
SF Median Total Direct Costs per Claim	\$28,228	\$18,083	\$14,166	\$6,032	\$14,245

SF: State Fund, SI: Self Insured, TL = Time Loss

*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 Compensable

Figure 3. Washington Compensable WMSD Rates by Industry Sector, BACK, 2002-2010.

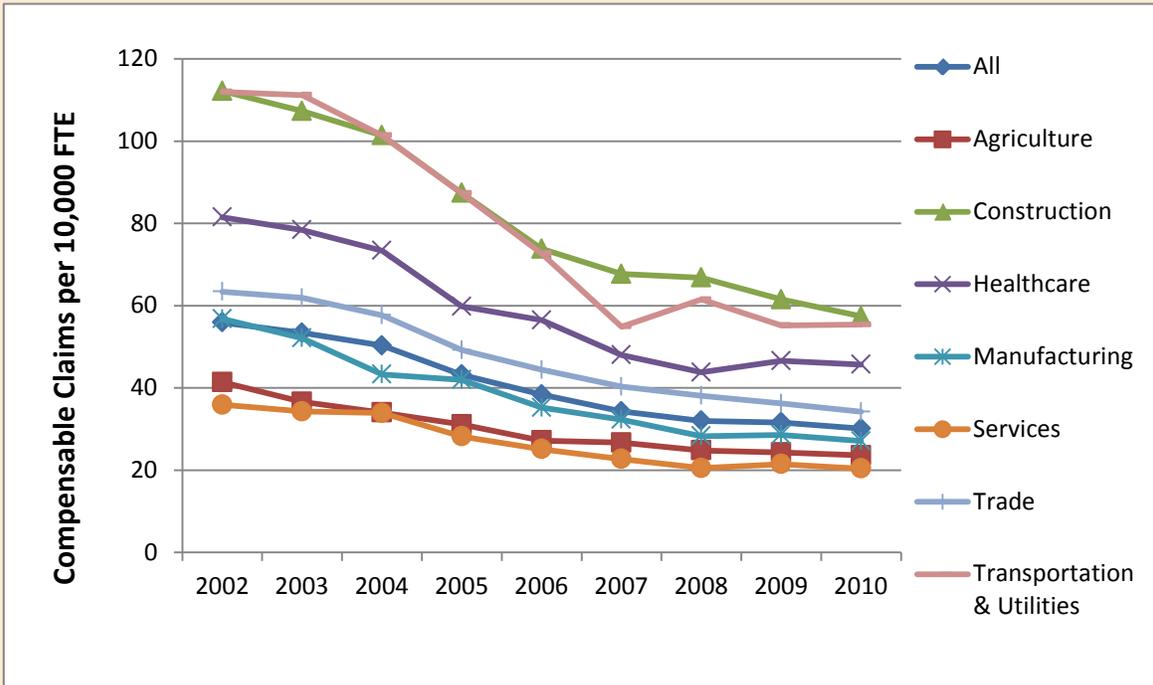
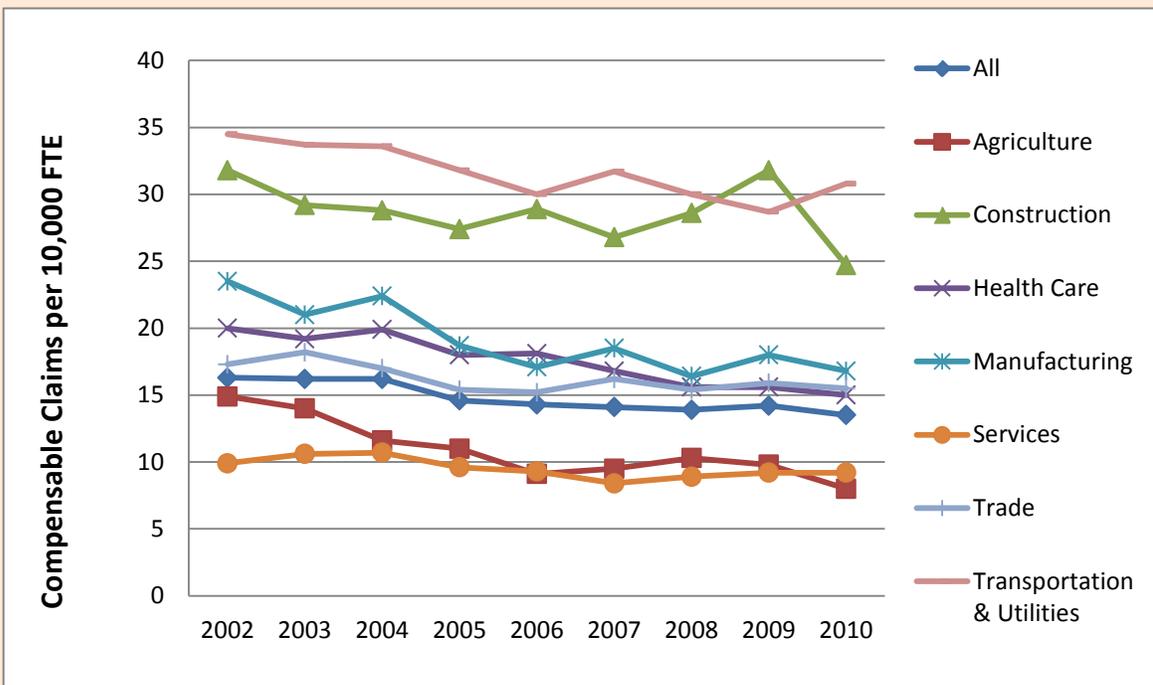


Figure 4. Washington Compensable WMSD Rates by Industry Sector, SHOULDER, 2002-2010.



By Specific Condition

In terms of specific condition or diagnoses, only State Fund (SF) data were available.

CIRs were decreasing for all conditions, though this varied by condition and industry sector and industry group.

Carpal tunnel syndrome (CTS) incidence rates were decreasing (Figure 5), although CTS claims had the highest CIR of the specific conditions (Table 5). Rates of rotator cuff syndrome (RCS) showed the least decrease by year (Figure 6), and had the highest severity rate (SR) (Table 5), while sciatica had the highest (average and median) costs per claim (Table 5).

Figure 5. Washington Compensable WMSD Rates by Industry Sector, Carpal Tunnel Syndrome, 2002-2010.

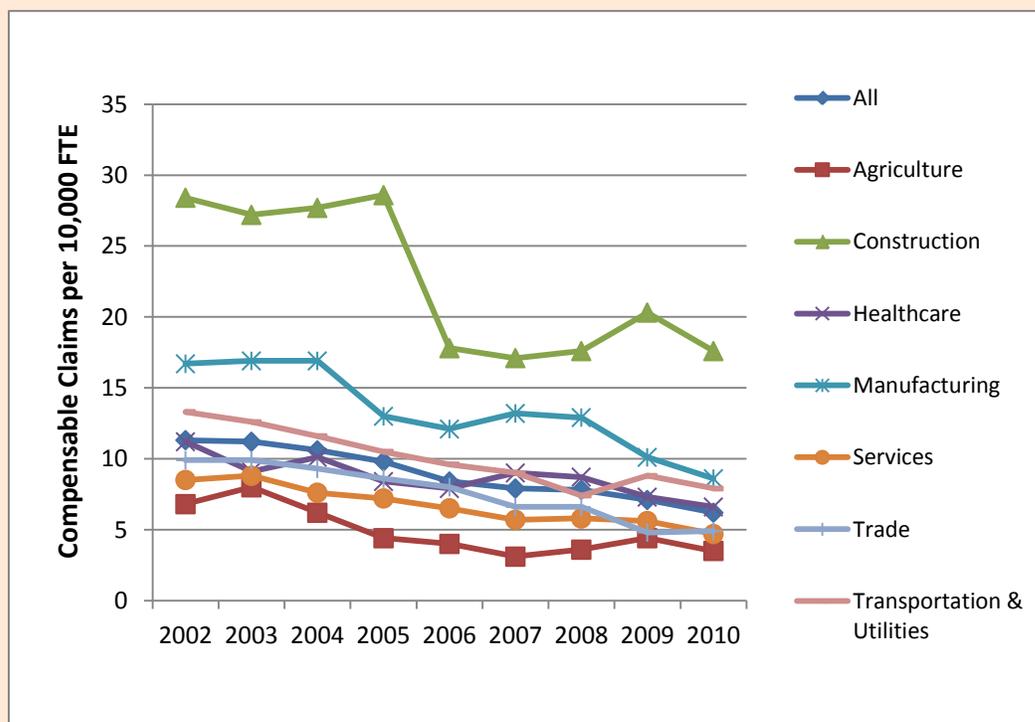


Table 5. Washington State Compensable Claims. Examples of Selected ICD-9 Diagnoses of WMSDs, 2002-2010. State Fund Only.

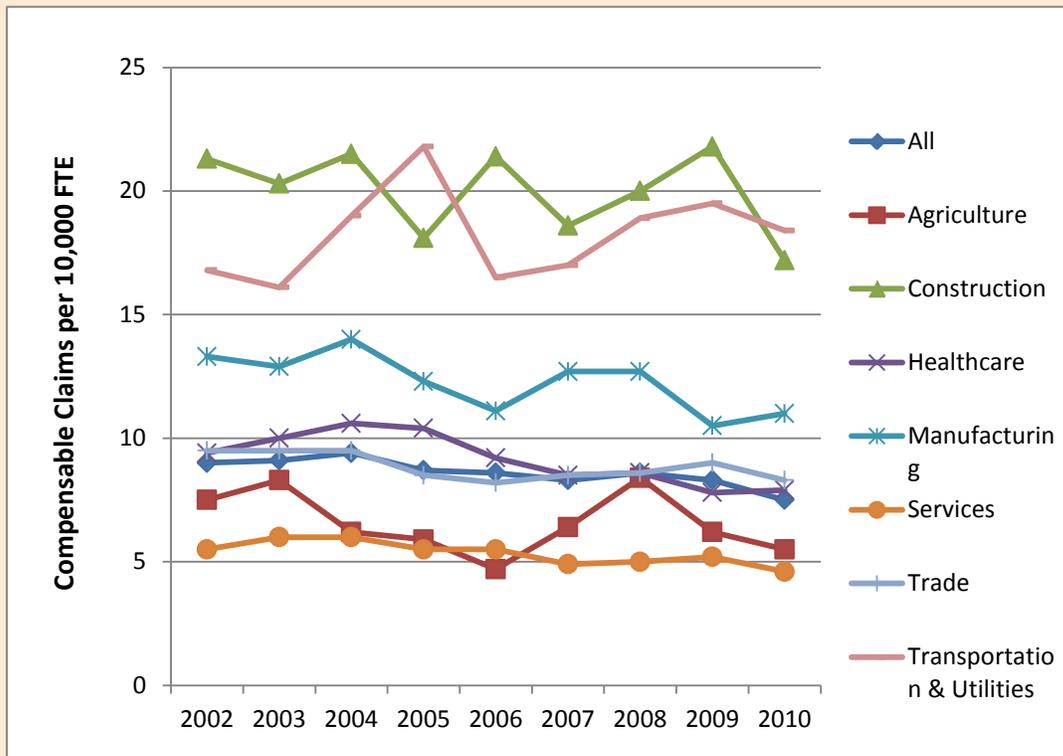
	Rotator Cuff Syndrome	Epicondylitis	Hand Wrist Tendonitis	Carpal Tunnel Syndrome	Sciatica	Knee Bursitis
Total Compensable Claims (SF)	12,121	3,071	6,582	12,462	4,538	483
% of ALL Compensable Claims	3.0%	0.7%	1.6%	3.0%	1.1%	0.1%
Combined SF Indemnity Costs (\$Millions)	\$562.6	\$108.0	\$204.2	\$400.5	\$317.2	\$16.6
State Fund Medical Costs (\$Millions)	\$335.1	\$61.2	\$128.3	\$216.5	\$182.7	\$10.3
Average # Claims per Year (SF)	1,347	341	731	1,385	504	54
Percent Female (SF)	35.0%	44.1%	62.0%	57.5%	32.4%	19.0%
Median Age (SF)	46	43	43	45	42	41
Median BMI (SF)	28.1	27.4	27.4	29	27.8	28.3
Median Tenure Months (SF)	29.4	28.2	29.2	30.1	28.5	28.7
Claims Rate per 10,000 FTE (SF)	6.2	1.6	3.4	6.4	2.3	0.2
SF Severity (TL days per 10,000 FTE)	3,373.5	769.5	1,456.6	2,653.6	1,836.4	97
SF Average TL Days per Claim	428.4	378	333	321.3	613.2	316
SF Median TL Days per Claim	192	129	95	100	303	60
SF Average Total Direct Costs per Claim	\$74,061	\$55,121	\$50,553	\$49,481	\$110,113	\$55,665
SF Median Total Direct Costs per Claim	\$37,835	\$19,484	\$15,721	\$17,536	\$46,872	\$12,424

SF: State Fund, SI: Self Insured, TL= Time Loss

* BMI=weight in kilograms/height in meters², Hgt / Wt were available for 91.4% of SF Compensable

**Tenure was available for 76.6% of SF Comp

Figure 9. Washington Compensable WMSD Rates by Industry Sector, Rotator Cuff Syndrome, 2002-2010.



Conclusions

Work-related musculoskeletal disorders continue to be a large and costly problem in Washington State, costing over \$5 billion for State Fund claims alone over the report period. On average, there were nearly 50,000 WMSDs of the upper extremity, back, and knee every year. 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 is evidence of under-reporting of disorders in the literature, and the indirect costs to the employer, employee and society are not included. Based on the Prevention Index rankings, Construction, Transportation & Utilities, and Health Care & Social Assistance continue to be high risk industry sectors for WMSDs in workers in Washington State.

Overall, the Top 10 industry groups (ranked by PI) for all WMSD claims were:

1. Scheduled Air Transportation (NAICS 4811)
2. Foundation, Structure, & Building Exterior Contractors (NAICS 2381)
3. Building Equipment Contractors (NAICS 2382)
4. Couriers & Express Delivery Services (NAICS 4921)
5. Nursing Care Facilities (NAICS 6231)
6. General Medical & Surgical Hospitals (NAICS 6221)
7. Building Finishing Contractors (NAICS 2383)
8. General Freight Trucking (NAICS 4841)
9. Grocery Stores (NAICS 4451)
10. Residential Building Construction (NAICS 2361).

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. The biggest prevention impact for upper extremity disorders can be achieved by reducing the duration or frequency of exposure to high forces. For the back, the biggest prevention impact can be achieved through the elimination of awkward or heavy manual handling tasks through redesign and modification. Ideas on how to reduce specific hazards in different industries can be found in the Department of Labor & Industries Ergonomics Ideas

Bank: <http://www.lni.wa.gov/Safety/Topics/ReduceHazards/ErgoBank/default.asp>.

GLOSSARY

KEY TERMS

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

Full-Time Equivalent (FTE): a full-time employee works 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.

SPECIFIC CONDITIONS

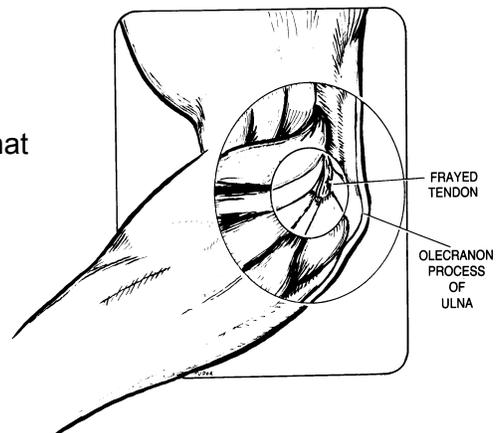


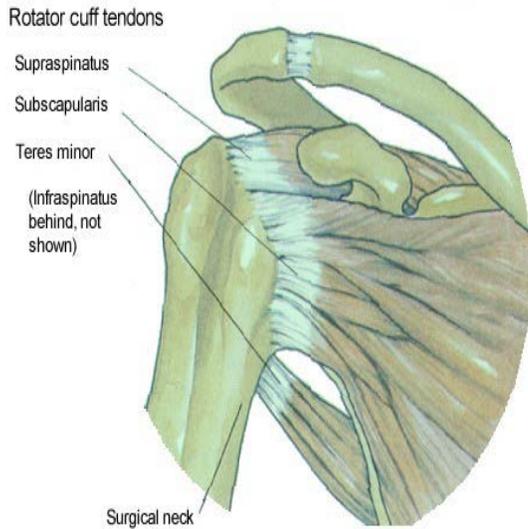
Carpal tunnel syndrome (CTS) is the compression of the median nerve at the wrist, due to ischemia or inflammation. CTS is characterized by numbness, tingling, or pain in the median nerve distribution of the hand (first 3 ½ fingers), frequently worse symptoms at night. Work-related CTS has been associated 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.

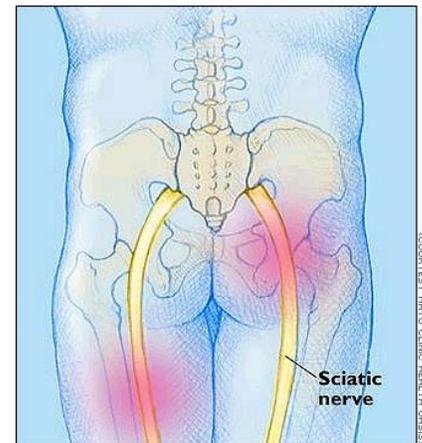
Repetitive forceful postures such as twisting or pronation of the forearm combined with extension of the wrist while gripping have been associated with epicondylitis.





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).