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Work related injuries in Washington State's Trucking Industry, by industry sector and occupation

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ABSTRACT

Background: The trucking industry continues to have some of the highest work-related injury and illness rates and costs of any industry in the United States. Until recently, little focus has been placed on addressing non-motor vehicle collision related injuries within the trucking industry. Drivers are exposed to multiple physical risk factors that contribute to occupational injuries in order to complete their job duties, such as loading/unloading freight, decoupling trailers, strapping down loads and ingress and egress from the cab and trailer. About one-fourth of all truck driver injuries in the United States are related to slips, trips, and falls near the truck.
Purpose: The purpose of this descriptive study is to report on recent injuries in the trucking industry in Washington State. Data are presented by occupation and industry sector, in order to better understand the magnitude of specific injuries in terms of time-loss days and workers' compensation costs.
Methods: All accepted, compensable (time-loss) claims from 2005 to 2010 within the trucking industry in Washington State were reviewed. Counts, rates, median and quartile data are presented. Logistic regression models are presented to identify factors associated with more severe claims.
Results: Non-traumatic musculoskeletal disorders of the neck, back and upper extremities are the most frequent injuries across all industry sectors and occupations in the trucking industry. Vehicle related claims had the highest median costs and time loss days and Courier and Messenger claims had the highest risk for higher time loss claims. Injuries varied substantially by sector and within sectors by occupation.
Conclusion: It is important to review work-related injuries within the trucking industry by sector and occupation in order to maximize limited resources for injury prevention within this important sector.
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1. Introduction

The trucking industry continues to have some of the highest work-related injury and illness rates and costs of any industry in the United States (Leigh et al., 2004; Bonauto et al., 2006). Leigh et al. using the US Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII) data and BLS Census of Fatal Occupational Injuries (CFOI) data found that the trucking and courier services industry had the highest total cost of fatal and nonfatal occupational injuries and illnesses and ranked eighth across industries in the average cost of work-related injuries and illnesses per worker (Leigh et al., 2004).

In response to public pressure, the federal Department of Transportation, through the Federal Motor Carrier Safety Administration (FMCSA) regulates the trucking industry, tightly controlling rest breaks and drive time in an attempt to eliminate motor vehicle collisions. While it is important to protect truck drivers and the motoring public from motor vehicle collisions, the majority of work-related injuries to truck drivers are from other causes. Non-traffic related incidents account for 92.6% of the registered occupational injuries among truck drivers in Denmark (Shibuya et al., 2008) and non-vehicle related injuries account for 93% of injuries to truckers in Washington State (Rauser et al., 2008). The situation regarding injuries in trucking is critical to address now, as trucking is one of the largest growing industry sectors in the United States.

The 2010 Bureau of Labor Statistics data estimated that there were 1.6 million heavy and tractor-trailer truck drivers in the United States, and projected a 21% increase in employment over the next ten years. By 2020, there will be an estimated 330,000 new jobs in the trucking industry, the eighth highest occupation in terms of new jobs (Bureau of Labor Statistics, 2012).

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The trucking industry in the United States is regulated by several federal and state agencies; the Federal Department of Transportation (DOT) and the Federal Motor Carrier Safety Administration (FMCSA) whose primary concerns are road and public safety. Most trucking companies place a major emphasis on meeting FMCSA requirements rather than occupational health and safety regulations as monitored by Occupational Safety and Health Administration (OSHA) or state OSHA plans (Belzer et al., 2002).

1.1. Purpose of the study

Until recently, little focus has been placed on addressing work-related injuries within the trucking industry. Various job duties, such as loading/unloading freight, decoupling trailers, strapping down loads and ingress and egress from the cab and trailer, expose drivers to physical risk factors that contribute to occupational injuries. About one-fourth of all truck driver injuries in the United States are related to slips, trips, and falls near the truck (Helmkamp and Lundstrom, 2000).

The purpose of this descriptive analysis is to report on recent injuries in the trucking industry from the Trucking Injury Reduction Emphasis through Surveillance (TIRES) work-related injury surveillance system in Washington State. Data from the TIRES program allows directed education and prevention activities for the most common and highest cost injuries in the trucking industry (Tires, 2013).

2. Materials and methods

2.1. Workers' compensation system, data ascertainment, and variable definitions

The Washington State Department of Labor and Industries' (L&I) State Fund (SF) is the exclusive provider of workers' compensation insurance to Washington State employers, except for those employers who are able to self-insure (SI) or those covered by alternative workers' compensation systems (e.g., the federal government and the Longshore and Harbor Workers' Act). The L&I State Fund system covers approximately two-thirds of all employees in the State of Washington and approximately 99% of employers, and 100% of the companies classified under NAICS 4842 (Specialized Freight Trucking) in this study.

Workers' compensation compensable State Fund and Self-Insured claims with dates of injury from 2005 to 2010 were extracted from the Washington State Department of Labor and Industries workers' compensation data system. Although SI companies are not covered by L&I, they are required to submit some data for compensable claims to the department. Compensable claims are those with wage replacement following a three day waiting period, a permanent partial disability award, a fatality, a worker kept on salary by their employer,[1] or provisionally accepted claims. Data from both SF and SI companies consists of all compensable claims from workers' compensation accounts assigned to one of the following North American Industrial Classification System (NAICS) codes: 4841 (General Freight Trucking), 4842 (Specialized Freight Trucking), 492 (Couriers and Messengers) and 562 (Waste Collection).

[1] A worker "kept on salary" by their employer is an insurance designation that means the worker is being paid by their employer while they are off work with an injury. This lets the Department know that we will not be paying time loss payments for this claim. This keeps the money spent by workers' compensation down, which results in a lower cost assigned to the employer, thereby factoring in to lower premiums for that employer.

Claimant data extracted included: claimant's age at date of injury, gender, marital status, number of dependents, length of employment, health insurance benefits, occupation (SOC 2000 – Standard Occupational Code (OMB, 2000)), claimant's self-reported height and weight, Occupational Injury and Illness Classification System (OIICS) codes for injury nature, body part, source, secondary source, and event or exposure (Bureau of Labor Statistics, 2007).

For all State Fund claims, time loss days, total costs and medical costs were also obtained. Data on benefits were restricted to 2 years from the date of injury to allow each claim to have a common period of maturity. Claim costs data reflect that which had been paid during the 2-year period after the date of injury and adjusted to 2010 dollars.

2.2. Data calculations

For rates, denominator data were obtained from employment estimates calculated by the Washington State Department of Employment Security, Labor Market and Economic Analysis Division. Employment estimates were based on annual Occupational Employment Statistics (OES) surveys, which is a joint state and federal survey. The OES does not survey farms, the self-employed, owners in unincorporated firms, the military or unpaid workers (e.g., household and unpaid family members). The OES estimates provide a count of employees by industry (NAICS) and occupation; hours were estimated by multiplying each employee by 2000 h (assumed full-time 50 weeks per year of employment). Hours were calculated for OES data in order to standardize the denominator for injury rates.

Detailed Standard Occupational Classification (SOC) codes were aggregated into 4 categories: drivers, material handlers, vehicle service operators and other. Occupations were categorized based upon similar/related descriptions. In the OES data, there were over 900 five-digit SOC occupations within State Fund companies and over 700 listed for SI companies. Although most of the occupations were categorized in 'Other' occupations, Table 1 provides an overview of how detailed occupations were aggregated into the relevant occupational groups for this study.

Body Mass Index (BMI) was calculated from self-reported height and weight using weight (in pounds) divided by height (in.) squared, multiplied by 703 (weight (pounds)/[height (in.)]^2 × 703) equivalent to BMI = weight (kg)/height^2 (m^2).

3. Data analysis

Descriptive analyses for demographic and claim data were performed and the data were either categorized or in most cases the median and first and third quartiles were reported. The averages were not used (except for age and BMI) because of the skewed nature of the data. Incidence rates (IR) were standardized to units of 100 full-time equivalent workers (FTE). Incident rates and 95% confidence intervals (95% CI) were calculated for all reported rates. Rate ratios (RR) compare select trucking industry occupation rates to the same occupations in all non-trucking industries in Washington State. Data on rates and costs are not reported where there are fewer than ten claims in a group.

Logistic regression models were run to identify relevant predictors or worker characteristics that are at higher risk for four distinct outcomes: (1) expensive medical claims (higher than median cost), (2) higher time-loss days (higher than median time loss), (3) for partial disability claims and (4) total permanent disability claims. Analyses were performed in SAS v9.3.

Table 1
Select Standard Occupational Classification (SOC) used in each occupational group, proportions in each industry.

Occupation group		Industry				
SOC code	SOC description	General Freight	Specialized Freight	Couriers	Waste	All Other Industries
Drivers						
533031	Driver/sales workers	0.0066	0.0049	0.0063	0.0015	0.0041
533099	Motor vehicle operators, all other	0.0044	0.0099	0.0068	0.0022	0.0035
533041	Taxi drivers and Chauffeur	0.0032	–	0.0008	–	0.0016
533032	Truck drivers, heavy and tractor trailer	0.6697	0.5673	0.1124	0.1721	0.0224
533033	Truck drivers, light or delivery services	0.0878	0.0984	0.3500	0.0324	0.0144
537081	Refuse and recyclable material collectors	0.0008	–	–	0.5294	0.0016
Material handlers						
435011	Cargo and freight agents	0.0040	0.0005	0.0008	–	0.0004
452092	Farmworkers and laborers, crop, nursery, and greenhouse	0.0028	0.0005	0.0008	–	0.0183
472061	Construction craft laborer	0.0012	0.0033	0.0004	–	0.0255
537051	Industrial truck and tractor operators	0.0104	0.0049	0.0042	0.0132	0.0062
537062	Laborers and freight, stock, and material movers, hand	0.0711	0.1413	0.1416	0.0346	0.0389
519199	Production workers, all other	0.0144	0.0253	0.0258	0.0162	0.0423
536099	Transportation workers, all other	0.0038	0.0022	0.0110	–	0.0035
Other						
531021	First-line supervisors/managers of helpers, laborers, and material movers, hand	0.0104	0.0181	0.0127	0.0051	0.0517
119199	Managers, all other	0.0020	0.0055	0.0051	0.0029	0.0110
999999	Nonclassifiable	0.0493	0.0412	0.0448	0.0404	0.0717
439061	Office clerks, general	0.0026	0.0011	0.0021	–	0.0070
472073	Operating engineers and other construction equipment operators	0.0026	0.0038	–	0.0147	0.0054
311012	Nursing aides, orderlies, and attendants	–	–	0.0004	–	0.0255
472031	Carpenters	0.0004	–	–	0.0007	0.0309
Vehicle service						
493023	Automotive service technicians and mechanics	0.0008	0.0022	0.0025	0.0051	0.0082
493031	Bus and truck mechanics and diesel engine specialists	0.0196	0.0192	0.0013	0.0397	0.0046
499041	Industrial machinery mechanics	–	0.0005	–	–	0.0023
499099	Installation, maintenance, and repair workers, all other	0.0032	0.0044	0.0051	0.0132	0.0213
493042	Mobile heavy equip mechanics, except engines	0.0008	0.0027	–	0.0022	0.0014
499042	Maintenance and repair workers, general	0.0006	0.0011	0.0004	0.0007	0.0077
514121	Welders, cutters, solderers, and brazers	0.0004	0.0033	–	0.0213	0.0072

4. Results

4.1. Overall characteristics of the industry

General characteristics of all compensable claims from 2005 to 2010 are presented by trucking industry sectors in Table 2. A total of 10,171 claims were available. Time loss and medical costs are available only for State Fund claims, which comprise 62% (6.291) of compensable claims during this period. Medical and non-medical costs for Trucking Industry State Fund compensable claims for this period totaled over $295 million dollars and accounted for 1.4 million days of time loss. The average age of trucking employees was 43.6 years old (Table 2), with the youngest and most gender diverse industry sector being Couriers and Messengers in Self Insured claims (Table 2). The most common claim type across all trucking industry sectors was non-traumatic musculoskeletal disorders of the neck, back and upper extremities (WMSDs), accounting for 34–49% of compensable claims (Table 2). For State Fund claims, General Freight Trucking (NAICS 4841) had higher median time-loss and medical costs as well as time loss days, with 50% of claims having over 41 days of time loss and costing over $5000 (Table 2).

4.2. Injuries by industry sector

Table 3 describes State Fund compensable claims by industry sector and occupation. While truck drivers make up from two-thirds to three-fourths of the injured population in the State Fund claims for this period, they do not have either the highest median claim or median medical cost in any of the trucking sectors (Table 3). Truck drivers do appear to have the highest median time loss days in General Freight Trucking and Waste Collection (45 and 31 days, respectively; Table 3), and are tied with Other occupations in Specialized Freight with a median of 44 days of time loss (Table 3).

4.3. Injuries by sector, occupation and injury type

Table 4 further breaks down State Fund compensable claims by trucking sector, occupation and the most frequent injury types in trucking. These injuries are work-related, non-traumatic musculoskeletal disorders of the neck, back and upper extremities (WMSDs), falls from elevation, falls from same level, struck by an object, and motor vehicle related claims. Musculoskeletal disorders of the back, neck and upper extremity were the most common injuries across all trucking industries and occupations (Table 4), except for Material Handlers in Couriers and Messenger sector, where struck-by injuries were more common ($n = 12$ versus 11 for WMSDs; Table 4). It should be noted that for many sector/occupation/injury groups, the counts are quite small.

In General Freight Trucking falls from elevation and WMSDs had the highest median claim and medical costs across occupations, with the exception of the Other occupational group, for which Vehicle Related injuries had the highest total and medical costs (Table 4).

For Specialized Freight, Truck Drivers had the most motor vehicle related claims, which also had the highest median cost ($19,766) and tied with Other occupation vehicle related claims for the highest median time loss days (71 days; Table 4) among all occupations and injuries within this sector (see Table 4). The second highest median time loss day injuries were for WMSDs in the Other

Table 2
Descriptive statistics for Trucking Industry Sectors, State-Fund and Self-Insured compensable claims from 2005 to 2010 ($n = 10,171$).

Variable	Combined	State Fund				Self Insured[a]		
	State Fund and Self-Insured compensable claims ($n = 10,171$), n (%)	General Freight Trucking ($n = 3243$), n (%)	Specialized Freight Trucking ($n = 1781$), n (%)	Couriers and Messengers ($n = 527$), n (%)	Waste Haul ($n = 740$), n (%)	General Freight Trucking ($n = 1557$), n (%)	Couriers and Messengers ($n = 1752$), n (%)	Waste Haul ($n = 571$), n (%)
Age mean (SD)	43.6 (12.2)	44.7 (11.9)	43.1 (12.7)	40.7 (13.4)	40.1 (11.1)	44.8 (12.5)	39.6 (10.9)	40.1 (11.1)
Male	9156 (90.0)	3057 (94.3)	1688 (94.8)	455(86.3)	685 (92.6)	1407 (90.4)	1311 (74.8)	553 (96.9)
Married[b]	5558 (54.9)	1819 (56.1)	870 (48.9)	251 (47.6)	450 (60.8)	940 (60.8)	898 (51.9)	330 (59.3)
BMI mean (SD)	30.4 (6.3)	30.7 (6.4)	30.4 (6.4)	29.2 (6.6)	28.9 (5.1)	30.8 (6.2)	27.9 (5.0)	29.0 (5.1)
Occupation								
Driver	7377 (72.5)	2463 (76.0)	1211 (68.0)	416 (78.9)	547 (73.9)	1185 (76.1)	1150 (65.6)	405 (70.3)
Handler	1439 (14.1)	381 (11.7)	349 (19.6)	44 (8.4)	41 (5.5)	164 (10.5)	413 (23.6)	47 (8.2)
Vehicle service	342 (3.4)	102 (3.2)	61 (3.4)	1 (0.2)	72 (9.7)	33 (2.1)	23 (1.3)	51 (8.9)
Other	1103 (10.0)	297 (9.2)	161 (9.0)	66 (12.5)	80 (10.8)	175 (11.2)	166 (9.5)	68 (11.9)
Injury type								
Falls from elevation	904 (8.9)	380 (11.7)	242 (13.6)	46 (8.7)	50 (6.8)	101 (6.5)	63 (3.6)	22 (3.9)
Falls from same level	901 (8.9)	321 (9.9)	167 (9.4)	51 (9.7)	60 (8.1)	160 (10.3)	108 (6.2)	34 (6.0)
WMSDs[c]	3889 (38.2)	1116 (34.4)	636 (35.7)	178 (33.8)	298 (40.3)	563 (36.2)	851 (48.6)	247 (43.3)
Struck by	1266 (12.4)	469 (14.5)	222 (12.5)	70 (13.3)	105 (14.2)	167 (10.7)	181 (10.3)	52 (9.1)
Vehicle related	673 (6.6)	280 (8.6)	133 (7.5)	74 (14.0)	43 (5.8)	77 (5.0)	46 (2.6)	20 (3.5)
Other	2538 (24.9)	677 (20.9)	381 (21.4)	108 (20.5)	184 (24.9)	489 (31.4)	503 (28.7)	196 (34.3)
Fatal injury	26 (0.3)	16 (0.5)	4 (0.2)	1 (0.2)	5 (0.7)	0	0	0
Total medical costs[d]	$99,032,947	$51,933,324	$31,080,723	$7,053,288	$8,965,612	–	–	–
Total medical and non-medical costs[d]	$295,430,718	$157,003,197	$91,906,820	$17,691,033	$28,829,668	–	–	–
Total time loss days paid[d]	1,406,404	746,088	433,195	105,327	121,794	–	–	–
Medical costs: median (25–75th percentile)[d]	$5021 (1526–16,958)	$5263 (1625–17,756)	$5093 (1452–18,868)	$4686 (1810–14,142)	$4036 (1188–13747)	–	–	–
Non-medical costs: median (25–75th percentile)[d]	$3701 (653–21,743)	$4132 (702–22,686)	$3656 (658–23,363)	$2454 (352–17,482)	$3178 (702–17,505)	–	–	–
Time-loss days: median (25–75th percentile)[d]	38 (7–182)	41 (8–194)	38 (7–200)	33 (4–178)	29 (7–124)	–	–	–

[a] No Specialized Freight (4842) in Self-Insured claims.
[b] Missing $n = 54$.
[c] Work-related neck, back and upper-extremity non-traumatic musculoskeletal disorders.
[d] Data only available for State Fund compensable claims.

Table 3
Median costs by Industry Sector and Occupation 2005–2010 State Fund compensable claims.

Industry sector	Occupation	Count	Median (Q1, Q3)	Time loss days[a]	Claim cost[b]	Medical costs[b]
General Freight						
	Truck drivers	2463	Total	590,188	123,405,732	38,104,000
			Median (Q1, Q3)	45 (9–206)	10,449 (2464–41,501)	5444 (1773–18,279)
	Material handlers	385	Total	71,448	13,471,001	5,440,365
			Median (Q1, Q3)	29 (6–152)	4991 (1461–28,939)	3451 (1102–15,473)
	Vehicle service	104	Total	22,066	5,005,410	1,631,423
			Median (Q1, Q3)	16 (4–83)	5284 (1910–36,789)	3963 (1320–15,517)
	Other	302	Total	62,386	15,121,055	6,757,536
			Median (Q1, Q3)	38 (6–154)	11,966 (2830–37,736)	6952 (1896–17,353)
Specialized Freight						
	Truck drivers	1211	Total	320,679	69,791,157	20,958,837
			Median (Q1, Q3)	44 (9–249)	9975 (2608–45,679)	5487 (1579–20,247)
	Material handlers	349	Total	64,609	12,272,371	6,814,315
			Median (Q1, Q3)	27 (6–133)	4515 (1368–23,571)	3322 (1055–12,976)
	Vehicle service	60	Total	13,753	3,873,286	1,276,577
			Median (Q1, Q3)	29 (1–172)	16,546 (3682–56,604)	7341 (1603–27,820)
	Other	161	Total	34,154	5,970,007	2,030,993
			Median (Q1, Q3)	44 (6–176)	9707 (2770–29,737)	6083 (1967–16,434)
Couriers and Messengers						
	Truck drivers	416	Total	84,271	14,105,498	5,621,339
			Median (Q1, Q3)	34 (4–179)	7205 (2270–32,045)	4540 (1770–14,142)
	Material handlers	44	Total	5333	713,060	338,654
			Median (Q1, Q3)	35 (5–104)	7037 (2270–18,808)	4798 (1726–12,017)
	Vehicle service	1	Total	–	–	–
			Median (Q1, Q3)	–	–	–
	Other	66	Total	15,723	2,857,908	1,088,514
			Median (Q1, Q3)	27 (6–192)	7438 (2913–31,693)	5580 (2206–19,885)
Waste Collection						
	Truck drivers	547	Total	90,151	20,788,477	6,761,927
			Median (Q1, Q3)	31 (7–128)	6554 (2090–31,411)	3826 (1160–14,557)
	Material handlers	41	Total	5641	1,086,540	429,917
			Median (Q1, Q3)	21 (5–115)	7105 (2225–17,608)	5048 (1365–8385)
	Vehicle Service	72	Total	10,088	2,612,564	926,646
			Median (Q1, Q3)	20 (2–92)	8160 (1936–26,451)	4475 (1177–12,266)
	Other	80	Total	15,914	4,342,086	847,122
			Median (Q1, Q3)	28 (9–153)	8058 (2586–33,476)	3935 (1469–16,306)

[a] For claim categories with less than 10, no data are given.
[b] Adjusted to 2010 U.S. dollars.

occupational category (88 days). These injuries also had the highest medical median cost ($10,054).

Couriers and Messengers are the smallest group among the sectors with State Fund compensable claims, having only 527 claims during this study period.[2] For Couriers and Messengers, the majority of their claims were among Truck Drivers ($n = 416$), with vehicle related injuries having the highest median costs ($15,416), followed closely by WMSDs among the Other occupations ($15,077), which were also second highest in time loss days (59 days) following Truck Drivers for falls from elevations (93 days) (Table 4).

The most expensive injury types for the Waste Haul sector were for other injury types within Other occupations (Table 4). For those injuries that are more identifiable, the highest median costs were for vehicle related injuries among Truck Drivers ($16,036), followed by struck-by injuries among Vehicle Service workers (median $11,923) (Table 4). For Truck Drivers, Vehicle Service and Other occupations, WMSDs had the highest median time loss days among all injury types at 45, 50 and 42 days, respectively (Table 4).

4.4. Incidence rates for trucking sectors compared to non-trucking industries

Table 5 provides incidence rates (IR) for injuries in each trucking sector and occupation as well as incidence rate ratios (IRR) showing how they compare to all other industries matching on occupation.

4.4.1. Incidence rates

General Freight Trucking had the highest overall incidence rate among trucking and non-trucking industries at 4.11 (95% CI 4.00–4.22) per full-time equivalent (FTE) employee (Table 5). While Waste and Recycling had the lowest overall incident rate (IR 1.22, 95% CI 1.15–1.28), Drivers in this industry sector had the highest overall incident rate at 5.47 per 100 FTE (95% CI 5.14–5.82). Drivers in each industry sector, including All Other Industries, had the highest incidence rates of all occupations in each industry ranging from IR of 3.9 (95% CI 3.85–3.97) in All Other Industries, to an IR of 5.47 in Waste and Recycling (Table 5).

4.4.2. Incidence rate ratios

Incidence Rate Ratios (IRRs) were calculated for each of the four occupation categories in order to compare non-trucking industries (All Other Industries) to similar occupations within each trucking sector. All trucking sectors, except Waste Haul, had overall rate ratios higher than All Other Industries, with General Freight Trucking having almost 3 times higher incident rate ratio (IRR 2.9, 95% CI 2.82–2.98) (Table 5). Comparing occupations between trucking sectors and All Other Industries though shows that injury rates among specific occupations are not necessarily higher than All Other Industries. Material Handling workers for example, in all trucking sectors except General Freight, had rate ratios below one when compared to Material Handling workers in All Other Industries, and Vehicle Maintenance workers in Waste and Recycling had a rate ratio lower than one when compared to similar workers in All Other Industries (Table 5).

[2] Couriers and Messengers are most likely under-represented in this study, as the largest courier and messenger companies are self-insured in Washington State.

Table 4
Costs by industry sector, occupation and injury type 2005–2010 State Fund compensable claims.

Industry sector	Occupation	Injury type	Count	Time loss days[a] Median (Q1, Q3)	Total claim cost[b] Median (Q1, Q3)	Medical cost[b] Median (Q1, Q3)
General Freight						
	Truck drivers	Falls from elevation	300	62 (14–286)	14,558 (3378–53,791)	6696 (2413–26,943)
		Falls from same level	254	57 (12–246)	10,011 (2477–51,269)	4991 (1711–20,812)
		WMSDs[c]	809	62 (11–251)	13,330 (2662–47,065)	7074 (1802–19,620)
		Struck by injuries	335	23 (5–99)	7126 (1809–26,554)	3595 (1103–12,281)
		Vehicle related	255	45 (8–259)	11,280 (3455–60,875)	5719 (2148–20,108)
		Other	510	32 (5–99)	8708 (2736–22,933)	4499 (1776–11,327)
	Material handlers	Falls from elevation	45	30 (7–262)	7271 (2254–36,840)	6349 (1943–22,001)
		Falls from same level	31	42 (5–137)	4032 (1566–14,981)	3219 (901–11,528)
		WMSDs[c]	152	39 (7–185)	6126 (1393–31,485)	5199 (1009–17,193)
		Struck by injuries	64	19 (3–56)	2883 (1084–12,286)	1740 (874–9922)
		Vehicle related	9	–	–	–
		Other	80	29 (3–116)	3846 (1296–22,438)	2144 (942–11,442)
	Other	Falls from elevation	27	76 (7–272)	20,832 (4221–44,047)	11,639 (3845–18,343)
		Falls from same level	29	49 (9–116)	10,031 (2712–32,889)	6642 (1611–12,607)
		WMSDs[c]	121	33 (7–234)	12,105 (2956–41,789)	6426 (1679–21,900)
		Struck by injuries	49	15 (2–76)	5595 (1205–28,329)	4151 (1087–16,352)
		Vehicle related	14	311 (57–916)	44,971 (16,942–136,085)	22,241 (13,685–47,117)
		Other	57	48 (2–92)	10,031 (2477–26,700)	6294 (1958–13,968)
	Vehicle service	Falls from elevation	8	–	–	–
		Falls from same level	7	–	–	–
		WMSDs[c]	34	20 (5–498)	7201 (1,70–65,597)	4760 (1320–27,411)
		Struck by injuries	21	14 (7–48)	4045 (1838–13,883)	1831 (1094–6334)
		Vehicle related	2	–	–	–
		Other	30	13 (0–18)	4395 (1720–8621)	3963 (1097–6792)
Specialized Freight						
	Truck drivers	Falls from elevation	191	47 (13–215)	13,283 (2842–48,455)	7549 (1924–23,686)
		Falls from same level	123	45 (8–250)	10,860 (2546–532,255)	6353 (1194–20,255)
		WMSDs[c]	406	55 (14–299)	9991 (2705–43,648)	5824 (1632–19,537)
		Struck by injuries	121	23 (4–173)	5961 (1511–28,596)	3030 (1011–12,361)
		Vehicle related	115	71 (12–563)	19,766 (4070–91,664)	8281 (2386–33,947)
		Other	255	28 (5–145)	9034 (2274–32,719)	4775 (1391–14,904)
	Material handlers	Falls from elevation	33	19 9–76)	5596 (1368–20,339)	4520 (1264–18,589)
		Falls from same level	22	44 (5–483)	14,073 (2529–50,675)	10,065 (1517–28,553)
		WMSDs[c]	145	41 (7–204)	5809 (1303–26,749)	3757 (1072–17,609)
		Struck by injuries	66	22 (6–82)	2987 (1103–16,562)	1969 (765–9984)
		Vehicle related	7	–	–	–
		Other	76	23 (5–57)	4239 (1604–10,214)	3229 (1105–5503)
	Other	Falls from elevation	13	31 (0–93)	3975 (1506–25,203)	2139 (1295–15,736)
		Falls from same level	18	60 (21–189)	13,361 (7724–29,737)	8207 (4595–15,474)
		WMSDs[c]	62	88 (12–303)	15,647 (6494–43,956)	10,054 (3632–23,788)
		Struck by injuries	24	17 (1–59)	5961 (1211–21,251)	4773 (923–7831)
		Vehicle related	10	71 (14–217)	7352 (2494–47,521)	6072 (2598–11,319)
		Other	34	30 (7–56)	6043 (2813–18,992)	3117 (1595–7623)
	Vehicle service	Falls from elevation	5	–	–	–
		Falls from same level	4	–	–	–
		WMSDs[c]	23	19 (0–172)	16,654 (1128–87,938)	6403 (1387–22,197)
		Struck by injuries	11	27 (9–527)	18,441 (2823–116,914)	9999 (1468–37,741)
		Vehicle related	1	–	–	–
		Other	16	39 (0–230)	14,682 (6872–106,131)	7341 (4446–43,282)
Couriers and Messengers						
	Truck drivers	Falls from elevation	37	93 (11–333)	11,184 (3453–41,834)	6490 (1785–12,276)
		Falls from same level	39	35 (4–427)	6109 (1541–56,305)	4948 (1541–27,188)
		WMSDs[c]	138	35 (3–182)	7330 (1973–28,910)	4767 (1631–15,094)
		Struck by injuries	49	26 (4–125)	5923 (1561–16,538)	3897 (2217–9723)
		Vehicle related	64	31 (1–243)	15,416 (3281–47,900)	8372 (2519–18,614)
		Other	89	26 (4–91)	5203 (2191–19,057)	3591 (1124–9498)
	Material handlers	Falls from elevation	4	–	–	–
		Falls from same level	5	–	–	–
		WMSDs[c]	11	55 (14–226)	8324 (2226–29,894)	6569 (4918–15,261)
		Struck by injuries	12	11 (1–59)	4864 (1324–11,626)	4323 (825–9700)
		Vehicle related	3	–	–	–
		Other	9	–	–	–

Table 4 (*Continued*)

Industry sector	Occupation	Injury type	Count	Time loss days[a] Median (Q1, Q3)	Total claim cost[b] Median (Q1, Q3)	Medical cost[b] Median (Q1, Q3)
	Other	Falls from elevation	5	–	–	–
		Falls from same level	7	–	–	–
		WMSDs[c]	29	59 (19–374)	15,077 (3658–81,027)	10,537 (3180–47,959)
		Struck by injuries	9	–	–	–
		Vehicle related	7	–	–	–
		Other	9	13 (9–24)	6691 (5019–11,016)	4473 (3689–6113)
	Vehicle service	Other	1	–	–	–
Waste Haul						
	Truck drivers	Falls from elevation	35	28 (8–123)	9897 (3101–36,433)	7417 (2615–19,875)
		Falls from same level	44	32 (9–142)	8906 (2140–27,277)	4489 (1168–12,732)
		WMSDs[c]	226	45 (13–180)	9967 (2794–41,591)	6441 (1560–17,580)
		Struck by injuries	67	23 (5–95)	4884 (1499–20,117)	2206 (846–6135)
		Vehicle related	38	19 (7–222)	16,036 (2150–33,278)	5479 (753–18,608)
		Other	137	23 (5–95)	4574 (1272–12,642)	2532 (780–7049)
	Material handlers	Falls from elevation	6	–	–	–
		Falls from same level	4	–	–	–
		WMSDs[c]	11	21 (10–302)	8434 (1602–31,870)	5753 (855–12,712)
		Struck by injuries	9	21 (5–85)	4840 (1365–13,271)	3418 (1365–6189)
		Vehicle related	0	–	–	–
		Other	11	6 (3–46)	7074 (1389–13,124)	2454 (1127–5376)
	Other	Falls from elevation	4	–	–	–
		Falls from same level	7	–	–	–
		WMSDs[c]	34	42 (19–115)	7533 (2732–32,057)	3539 (1748–17,649)
		Struck by injuries	17	19 (5–41)	3450 (2,21–6051)	2004 (773–5221)
		Vehicle related	3	–	–	–
		Other	15	16 (0–276)	19,431 (1934–38,210)	5151 (1455–12,407)
	Vehicle service	Falls from elevation	5	–	–	–
		Falls from same level	5	–	–	–
		WMSDs[c]	27	50 (8–228)	11,441 (3114–36,298)	5583 (1866–16,133)
		Struck by injuries	12	37 (7–150)	11,923 (1579–33,107)	5738 (1203–15,121)
		Vehicle related	2	–	–	–
		Other	21	2 (0–34)	5803 (1336–12,714)	3135 (530–7995)

[a] For claim categories with less than 10, no data are given. Q1 = quartile 1, Q3 = quartile 3.
[b] Adjusted to 2010 U.S. dollars.
[c] WMSDs are work-related non-traumatic neck, back and upper extremity musculoskeletal disorders.

Table 5
Incidence rates and rate ratios for compensable injuries in Trucking and All Other Industries by occupation. Per 100 full-time equivalents (FTEs) 2005–2010.

Industry	FTE	Claims	Incidence rate (95% CI)[a]	Rate ratio[b] (95% CI)
Occupation				
General Freight Trucking	125,544	5158	4.11 (4.00–4.22)	2.9 (2.82,2.98)
Drivers	71,914	3875	5.4 (5.22–5.56)	1.4 (1.34–1.43)
Material handlers	10,401	562	5.4 (4.97–5.87)	1.3 (1.20–1.42)
Vehicle mechanics	5117	140	2.74 (2.30–3.23)	0.9 (0.76–1.06)
All other workers	38,112	581	1.52 (1.40–1.65)	1.4 (1.27–1.50)
Specialized Freight Trucking	65,172	1819	2.79 (2.66–2.92)	1.9 (1.85–2.03)
Drivers	29,799	1240	4.16 (3.93–4.40)	1.1 (1.01–1.13)
Material handlers	11,090	356	3.2 (2.89–3.56)	0.8 (0.70–0.86)
Vehicle mechanics	2157	61	2.83 (2.16–3.63)	0.9 (0.72–1.20)
All other workers	22,126	162	0.73 (0.62–0.85)	0.7 (0.57–0.77)
Couriers and Messengers	81,903	2406	2.94 (2.82–3.06)	2.0 (1.96–2.13)
Drivers	31,931	1644	5.15 (4.90–5.40)	1.3 (1.26–1.39)
Material handlers	20,971	486	2.32 (2.12–2.53)	0.6 (0.51–0.61)
Vehicle mechanics	812	26	3.20 (2.10–4.69)	1.1 (0.72–1.55)
All other workers	28,189	250	0.89 (0.78–1.00)	0.8 (0.71–0.92)
Waste & Recycling	114,111	1389	1.22 (1.15–1.28)	0.8 (0.80–0.89)
Drivers	18,324	1003	5.47 (5.14–5.82)	1.4 (1.32–1.49)
Material handlers	7118	94	1.32 (1.07–1.62)	0.3 (0.26–0.39)
Vehicle mechanics	5462	128	2.34 (1.96–2.79)	0.8 (0.65–0.92)
All other workers	83,207	164	0.20 (0.17–0.23)	0.2 (0.16–0.21)
All Other Industries	17,603,554	253,525	1.44 (1.43–1.45)	1.0
Drivers	411,339.52	16,073	3.9 (3.85–3.97)	1.0
Material handlers	1,080,054.8	44,763	4.14 (4.11–4.18)	1.0
Vehicle mechanics	490,232.78	14,881	3.04 (2.99–3.08)	1.0
All other workers	15,621,927	177,808	1.1 (1.13–1.14)	1.0

[a] 95% CI = 95th percentile confidence interval.
[b] Ratio of occupation rate over "All Other Industries" matching occupation rate.

Table 6
Logistic regression models for State Fund Trucking Industry Compensable Claims, 2005–2010.

Outcomes[a]	Model 1: higher than median medical costs ($n = 5525$), OR (95% CI)[b]	Model 2: higher than median time loss days ($n = 5583$), OR (95% CI)[b]	Model 3: permanent partial disability ($n = 5583$, OR (95% CI)[b]	Model 4: total permanent disability ($n = 5583$), OR (95% CI)[b]
Predictors				
Age				
Less than 35 years old	1.00	1.00	1.00	1.00
Between 35 and 55 years old	**1.55 (1.36–1.76)**	**1.48 (1.31–1.68)**	**1.71 (1.49–1.95)**	**10.86 (3.98–29.66)**
Greater than 55 years old	**1.91 (1.62–2.26)**	**2.03 (1.72–2.41)**	**2.08 (1.75–2.45)**	**47.66 (17.50–129.85)**
Female	**1.34 (1.07–1.66)**	1.18 (0.95–1.46)	1.08 (0.87–1.34)	0.75 (0.37–1.49)
Obese (BMI ≥ 30)	**1.17 (1.05–1.30)**	**1.20 (1.07–1.33)**	**1.21 (1.09–1.35)**	0.89 (0.67–1.19)
Injury type				
Other injuries	1.00	1.00	1.00	1.00
Falls from elevation	**1.80 (1.48–2.19)**	**1.61 (1.32–1.96)**	**1.40 (1.15–1.70)**	**2.25 (1.36–3.71)**
Falls from same level	**1.45 (1.18–1.79)**	**1.47 (1.19–1.81)**	1.14 (0.93–1.41)	1.50 (0.85–2.63)
WMSDs[c]	**1.73 (1.50–2.01)**	**1.58 (1.36–1.83)**	**1.42 (1.23–1.65)**	1.34 (0.85–2.10)
Struck by injuries	1.05 (0.87–1.27)	0.94 (0.78–1.14)	0.95 (0.79–1.16)	1.40 (0.80–2.45)
Vehicle related injuries	**1.88 (1.51–2.34)**	**1.75 (1.41–2.19)**	0.89 (0.71–1.12)	**2.79 (1.64–4.77)**
Trucking sector				
Waste Collection	1.00	1.00	1.00	1.00
General Freight Trucking	1.16 (0.97–1.38)	**1.32 (1.10–1.59)**	1.02 (0.86–1.21)	1.31 (0.72–2.36)
Specialized Freight Trucking	1.15 (0.95–1.38)	**1.32 (1.10–1.59)**	0.98 (0.81–1.18)	1.78 (0.97–3.27)
Courier and Messenger Trucking	1.09 (0.86–1.40)	**1.44 (1.13–1.84)**	0.90 (0.70–1.16)	1.17 (0.52–2.62)

Statistically significant OR (95% CI) in bold.
[a] Each outcome was modeled separately with the same covariates (listed as predictors).
[b] OR = odds ratio, 95% CI = ninety-fifth percentile confidence interval.
[c] WMSDs = work-related neck, back and upper-extremity non-traumatic musculoskeletal disorders.

4.5. Logistic regression results

Table 6 presents four multivariable logistic regression models for State Fund (SF) Compensable claims from 2005 to 2010, with four binary outcomes; (1) higher or lower than median medical costs, (2) higher or lower than median time-loss days, (3) partial permanent disability – yes/no, and (4) total permanent disability – yes/no. All models were run while controlling for the same predictor variables; age, gender, obesity (BMI ≥ 30), injury type and trucking sector.

4.5.1. Higher than median medical costs

Medical costs were dichotomized at the median ($5635). There were 2644 claims with higher than median costs in State Fund compensable claims during the study period. Falls (same level and elevation), WMSDs and Vehicle related injuries, were more likely than Other injuries to be associated with higher than median medical costs (Table 6). Being over 35 years old, female and having a BMI equal to or over 30, also were associated with having higher than median medical costs, compared to being younger than 35, male and having a BMI below 30 (Table 6).

4.5.2. Higher than median time-loss days

Statistically significant covariates in model two are similar to the significant covariates in model one, for instance being over 35 years old, having a BMI equal to or over 30, having a Fall (same level or from elevation), WMSD or a Vehicle related injury increased the risk of having a time loss claim with greater than the median time loss days (Table 6). In addition, model two was the only model in which industry was statistically significant, with General and Specialized Freight having a 32% higher risk, and Couriers and Messengers having a 44% increased risk, compared to Waste Collection for having a higher than median time loss claim (Table 6). Being female produced slightly higher odds of having a greater than median time loss claim, but it was not statistically significant (OR 1.2, 95% CI 0.95–1.46).

4.5.3. Permanent partial disability

There were 2028 claims during this study period adjudicated as yes for permanent partial disability (PPD). Workers over age 35, with fall from elevation injuries or WMSDs, were more likely to have a PPD compared to workers younger than 35 years old, and with Other injuries (Table 6).

4.5.4. Total permanent disability

Although some characteristics listed in Table 6 had statistically significantly higher risk for having a total permanent disability (TPD) than the referent groups, the sample size for yes on TPD was small ($n = 203$), so caution should be taken when interpreting these results. For example, those who were greater than 55 years old had almost 50 times the odds of having a TPD than those younger than 35 (OR 46.9) but the confidence intervals were quite wide (95% CI 17.2–127.8) (Table 6).

5. Discussion

The trucking industry has among the highest costs and rates for workers' compensation claims in Washington State. This is similar to national rate data, although detailed cost data do not exist for national level estimates of the burden of work-related injuries in the trucking industry. The trucking sectors analyzed in this study, except Waste and Recycling, had higher overall rates of injury compared to non-trucking industries (Table 5). While Waste and Recycling had the lowest overall injury rate (IR 1.22) it had the highest occupation specific rate per FTE for Drivers (IR 5.47), underscoring the importance of looking at injury rates by industry and occupation, rather than taking an industry as a uniform rate. This study found that injuries in the trucking industry differ by sector as well as by occupation, further defining possible areas for injury prevention efforts. For General Freight Trucking, falls from elevation and WMSDs had the highest median claim and medical costs for all occupations except Other, where vehicle related injuries were more likely to have higher median costs. Specialized Freight and Waste and Recycling on the other hand, had different injury types with higher median costs varying significantly by occupation (Table 4).

While medical and non-medical costs are used to calculate the financial burden to employers and employees in this study, they account for a limited proportion of the true cost of work-related injuries. A recent study by Leigh (2011) found that workers' compensation covers only about 25% of the true cost of claims.

Nevertheless, the data we report as being directly related to workers' compensation claims (over $295 million for State Fund claims) is significant. This money could be better allocated to training, maintenance and other safety and health related activities and could save businesses even more money, considering lower industrial insurance premium rates and the cost of hiring and training as examples of the many un-counted costs in this analysis.

While this study provides a detailed look at injuries within trucking industry sectors and within specific occupations, it relied upon FTE estimates to determine rates. There may be some occupations that have more part time employees than others, so the counts may not have always reflected full time workers, but these estimates are sent by Washington State to the Bureau of Labor Statistics for their quarterly reporting, so are similar to what could be found nationally. In addition, occupations were aggregated into four main occupational categories, so some important details may have been lost for specific occupations. As Table 1 provides the distribution of detailed occupations by Trucking Sector and All Other Industries, we can see that for some of the most frequently used SOC codes in our injury data, most occupations are distributed relatively uniformly. Drivers of heavy trucks are overrepresented in the trucking sectors, but this is to be expected based on our study design. Unfortunately our denominator data from the OES does not contain demographic information so we were not able to calculate rates by gender or age, which might have produced interesting results.

By providing detailed analyses of injuries by trucking sector, occupation and injury type, some of the results presented have very small counts, so caution should be taken when interpreting these results. Additional studies should be conducted with larger datasets to confirm our sector, occupation and injury results.

This study found that musculoskeletal disorders were the most common injuries across all trucking industry sectors; this is similar to previous studies (Van Der Beek et al., 1993; Magnusson et al., 1996; Robb and Mansfield, 2007; Friswell and Williamson, 2010), although we did not report WMSDs by body part, as previous studies have done; back, neck and upper extremities did account for over 50% of the body parts affected with WMSDs in this study (data not shown). Similar to Mccall and Horwitz (2005), who focused on vehicle crashes, our data supports their findings that vehicle related incidents are costly and have longer time-loss than other types of injuries, although our median time loss days were much higher for drivers than what was found in Oregon (Mccall and Horwitz, 2005). The vehicle related injury data in the Washington State WC data reflects injuries where a vehicle was associated with the injury, but not necessarily motor vehicle crashes (MVCs). A review of the first report of injury text description would be required to differentiate MVCs in this dataset.

6. Conclusion

This study provides work-related injury costs, and time loss days for the trucking industry by sector, occupation and injury type in Washington State. While costs may differ by state workers' compensation systems, the injury types are similar to what has been found in previous studies (Friswell and Williamson, 2010; Shibuya et al., 2010) suggesting the magnitude of the most expensive injuries and the occupations within sectors that are at risk for different types of injuries should be generalizable to the larger national trucking industry. Not all occupations within trucking are suffering from the same injuries and not all occupations across sectors have similar risks. It therefore seems prudent with limited resources for health and safety activities to identify what injuries are happening in which occupations in order to better target prevention efforts.

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