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Assessment of perceived injury risks and priorities among truck drivers and trucking companies in Washington State

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ABSTRACT

Problem: The trucking industry experiences one of the highest work-related injury rates. Little work has been conducted previously in the United States to assess the hazards, needs, and injury prevention priorities in trucking. *Method:* Two separate industry-wide surveys of 359 trucking companies and 397 commercial truck drivers were conducted in Washington State. *Results:* Trucking companies and drivers both ranked musculoskeletal and slip, trip, fall injuries as the top two priorities. Controlling heavy lifting, using appropriate equipment, and addressing slippery surfaces were frequently listed as solutions. There appears to be a gap in safety climate perception between workers and employers. However, driver and company priorities agreed with industry workers' compensation claims. There is room for safety program management improvement in the industry. The study findings detail opportunities for prioritizing and reducing injuries. *Impact on Industry:* This information can be used to focus and design interventions for the prevention of work-related injuries while improving industry competitiveness.

1. Problem

Industry sub-sectors that comprise the trucking industry experience some of the highest incident and prevalence of work-related injuries compared to other industries (Bonauto, Silverstein, Adams, & Foley, 2006; Leigh, Waehrer, Miller, & Keenan, 2004). Yet relatively few resources have been invested in the research and development of prevention strategies. This is changing with the implementation of the second National Occupational Research Agenda (NORA II) by the National Institute for Occupational Safety and Health (NIOSH). This sector-based approach to identifying research priorities includes Transportation, Warehousing and Utilities as one of the eight industry sectors.

The Bureau of Labor Statistics Census of Fatal Occupational Injuries (BLS, 2007a) reported 555 fatalities in truck transportation in 2006 and a rate of 27.3 per 100,000 workers, which accounts for nearly 10% of all work-related fatalities and at an incidence much higher than that for all industries (4.0 per 100,000 workers). The non-fatal injury rate in 2006 was 5.8 per 100 full-time workers for Truck Transportation, and 10.5 per 100 full-time workers for Couriers and Messengers, compared to a rate of 4.4 for all private industry (BLS, 2007b). With an employment of over 2 million workers, this sub-sector of U.S. industry experiences some of the highest numbers and rates of fatal and non-fatal injuries.

Previous research surveys of truck drivers have been conducted in the United States, however most of this work has focused on hours of service, driver fatigue, and motor-vehicle crash factors (Beilock, 1995; Braver et al., 1992; Monaco & Williams, 2000). A NIOSH conference in 2003 generated a report that identified many potential occupational health risks to truck drivers and research needs in this area (Saltzman & Belzer, 2007). Other research by Belzer, Rodriguez, and Sedo (2002) assessed specifically the impact of economics and other factors on truck driver safety as it pertained to crashes. However, very little survey research has focused on the assessment of the risk factors and perceived conditions that may promote injuries within trucking in the United States.

A survey in Australia by Mayhew and Quinlan (2000) assessed health and safety perceptions of truck drivers in New South Wales. This study found that 51% of truck drivers had experienced a chronic injury or illness in the previous 12 months, and 31% reported chronic back injuries. A measurement of mental health status was used and nearly all drivers were above "normal" stress levels according to the General Health Question (GHQ) with factors of financial stress, long hours, interstate driving, and overnight driving associated with higher stress scores. Another survey by Robb and Mansfield (2007) of self-reported musculoskeletal problems among truck drivers in the United Kingdom found that over 80% reported some musculoskeletal pain in the previous 12 months. Manual material handling and subjective ratings of seat discomfort were associated with the self-reported musculoskeletal pain.

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The Safety and Health Assessment and Research for Prevention (SHARP) Program initiated a project in partnership with the Washington State trucking industry called the Trucking Injury Reduction Emphasis (TIRES) Program. The goals of this program are to systematically identify and prioritize the types of injuries, identify root-cause hazards, and develop practical solutions to help the industry reduce the burden of lost-time injuries. As part of the first phase of the TIRES program, an analysis of Washington State workers' compensation data identified trucking industry groups as having some of the highest compensable workers' compensation claims rates in Washington State (Bonauto et al., 2006). Industry assignment was defined by the North American Industrial Classification System (NAICS) code assigned to the workers' compensation insurance account for each company. In Washington State, General Freight Trucking (NAICS 4841), Couriers (NAICS 4921), Specialized Freight Trucking (NAICS 4842), and Waste Collection (NAICS 5621) each ranked in the top eight industries for compensable workers' compensation claims from 1999-2003. A sub-set of this analysis also showed that most (at least 70%) of injuries in trucking were of four types: (a) upper extremity and back work-related musculoskeletal disorders (WMSDs); (b) slips, trips and falls; (c) struck-by injuries; and (d) motor-vehicle crashes.

The second phase of the TIRES Project was to conduct industry-wide surveys of both trucking employers and truck drivers to assess perceptions of hazards, needs, and priorities within Washington State trucking companies. The goals of the surveys were to: (a) obtain demographic information not available from administrative databases to better describe the work and organization of trucking companies, and the population of truck drivers; (b) assess worker and company priorities to better target educational needs and interventions; and (c) identify risk factors, solution strategies, and barriers to preventing occupational injuries from both the company and driver perspectives. The following presents results of these two surveys summarizing responses from trucking employers and truck drivers.

2. Methods

Two state-wide surveys were administered to employers and employees with commercial drivers licenses in the trucking industry. The employer survey, sent to Washington State trucking companies, assessed: (a) needs and priorities in the trucking industry, (b) reported causes of injuries with associated solutions and barriers to implementation, and (c) safety climate from the employer perspective. The employee survey asked truck drivers to assess their perceptions of: (a) the level of exposure to injury risk factors, (b) prevalence of pain/injury, (c) causes of injuries with associated solutions and barriers to implementation, and (d) safety climate.

Questions were developed through inclusion of questions from previous trucking survey research (Monaco & Williams, 2000; Mayhew & Quinlan, 2000) and through 12 months of structured interviews and focus groups with companies, labor unions, truck drivers, and industry associations in Washington State. The survey instruments were reviewed and pilot-tested by industry and labor partners for relevance, accuracy, and completeness of content.

2.1. Truck Driver Survey

A random sample of 2,189 drivers distributed across the trucking sector was taken from a database population of 18,988 current commercial drivers license (CDL) holders employed in trucking companies. The current CDL holders from the Washington State Department of Licensing were cross-referenced against a database from the Washington State Employment Securities Department to identify those employed by a company within the trucking industry North American Industry Classification System (NAICS) codes (NAICS 484, 492 and 5621). Phone numbers were not included in the data and were obtained by a directory look-up. Data-sharing agreement contracts were in place between agencies to assure integrity and security of any confidential data.

A total of 397 complete surveys were received from 700 qualified truck drivers, for a response-rate of 57%. There were 300 completed mail, 83 phone, and 14 web surveys. Out of the total sample, 1,489 were disqualified, 241 were unreachable, and 64 refused the survey. Of the disqualified sample, 1,071 either had a bad address or no listed phone number and 186 had a phone number that was either wrong or disconnected.

A survey with questions relating the type of work and trucking normally conducted, exposure to injury risk factors, reported pain/injury, risk prioritization (ranking from "most important to "least important"), safety climate (Dedobbeleer & Beland, 1991), and perceptions of injury causes (qualitative response), solutions (qualitative response) and barriers (qualitative response) was mailed to each truck driver in the spring of 2006. Postcard reminders were mailed 10-14 days after the first mailing, and telephone follow-up with standard protocol was initiated with non-responders after an additional seven days. A web survey form was included as a response method option on the mailed survey and the postcard follow-up.

2.2. Employer Survey

A total of 926 trucking companies were identified through Employment Security data within one of the associated trucking industry NAICS having at least five full-time-equivalent employees during each quarter in 2004. Surveys were mailed to each company in the spring of 2005, and 359 surveys were completed after postcard reminders and telephone follow-up protocols identical to that of the driver survey from 690 qualified companies (52% response). Out of the total sample 236 were disqualified, 240 were not reachable or did not respond, and 91 refused the survey.

Questions relating to company priorities and procedures were included in addition to applicable driver survey items. Injury types and profitability concerns were ranked from biggest concern or problem (score = 1) to smallest concern. Weighted ranking scores were calculated by multiplying each of the rank scores by the number of respondents for each category and then adding each category score together. The lower the weighted ranking score, the higher the problem was ranked overall by respondents.

Interviews with industry associations in Washington State identified a truck fleet size of 25 trucks as a cut-point definition for small and large companies in the survey, with the goal of obtaining a representative sample of both segments (Table 1). A descriptive analysis of all survey variables was conducted and relationships were explored between all variables where a plausible hypothesis existed for a comparison. Statistical differences were evaluated using the chi-square test statistic for ordinal data, and using independent samples t-tests for continuous data, with a significance level of 0.05. Significant differences by measure were evaluated by sub-sector, fleet size, and survey when applicable for each measure. Survey instruments and research methods involving human

Table 1
Survey Responses for Truck Driver and Employer Surveys by NAICS and Reported Fleet Size

Industry Sub-Sector (NAICS)	Truck Driver Respondents		Employer Respondents	
	<25 Trucks	≥25 Trucks	<25 Trucks	≥25 Trucks
General Freight (4841)	60	84	99	56
Specialized Freight (4842 excl 48421)	49	49	53	19
Waste Collection (5621)	19	21	19	6
Couriers & Messengers (492)	11	25	14	6
Used Household & Office Goods (48421)	35	13	43	9
Total	176	193	228	96

subjects were approved by the Washington State Institutional Review Board.

3. Results

3.1. Truck Driver Survey Response Summary

Of those reporting personal information (n=362), 98% were male, 19% were less than 40 years old, 45% were between 50 and 55 years old, and 36% were over 55. The most common method of compensation was by the hour at 70%, with 15% paid by the mile, 8% by the trip, and 7% as a percentage of revenue. A total of 35% each reported driving between 76-100% of the time and between 51-75% of the time, while 18% drove between 25-50% of the time, and 12% drove less than 25% of the time. A total of 19% of drivers reported handling cargo or material between 25-50% of the day, and 17% handled cargo 51-100% of the time, while 46% reported handling cargo between 0-25% of the time. The majority (85%) of drivers reported sitting idle less than 25% of the day.

Survey respondents most frequently (n=141) ranked back, shoulder or arm/hand overexertions/strains as the most important type of injuries, with lifting heavy objects as the number one cause of these injuries. Getting help, using equipment, equipment upgrades, and maintenance were the most frequently listed solutions. Repetitive hand or arm movements was most frequently (n=195) rated as a high injury risk. This was followed closely (n=185) by "activities that require very hard pulling, pushing or gripping."

3.2. Trucking Employer Survey Response Summary

The majority of respondents were either the owner, president, or vice-president of the company (n=146) or the personnel, safety and health, or other type of manager (n=145). Another 23 respondents were administrative assistants. Responding companies reported having an average fleet size of 35 (±143 std dev, median 12) trucks.

Trucking companies estimated that on average 17% (±17% std dev, median 10%) of their driving was done at night, non-driver employees worked an average of 36 (±14 std dev, median 40) hours per week, and drivers worked an average of 44 (±10 std dev, median 40) hours per week.

Trucking industry employers also prioritized sprains/strains and overexertions as the most important injury type. Awkward lifting and handling freight were reported as the primary cause of these types of injuries. The primary solutions cited to prevent sprains/strains and overexertions included training, work planning, and using proper equipment. A majority (64%) of employers thought that their level of business would increase over the next two years and 27% thought that it would be unchanged.

Fig. 1 presents the type of freight hauled by company respondents broken down by smaller and larger fleet sizes. Specialized Freight does not have NAICS codes that readily define the types of material hauled. Within Specialized Freight respondents, the most common types of material hauled were stated as General Freight (18% of respondents), Logs (13%), Construction Materials (13%), Wood/Paper Products (10%), and Agricultural Products/Supplies (8%).

3.3. Summary of Responses for Employer and Employee Surveys

Table 2 presents the weighted priority ranking of injury types from company respondents. Back, shoulder, arm and hand overexertion, or strain injuries were ranked as the most serious problem, followed closely by slips, trips, and falls. The rankings by employees mirrored that of the employers for each injury type. No differences in ranking were found between small and large (<> 25 trucks) companies or by industry sub-sector. Truck drivers ranked overexertion or strain injuries as one of the top two problems 59% of the time, and slip, trip, or falls as one of the top two problems 54% of the time.

The top two profitability concerns by companies were fuel costs and increasing costs of labor, healthcare, and workers' compensation insurance. Finding and keeping drivers was the third most important concern from the weighted rankings. Ranking of profitability concerns by trucking company respondents are presented in Table 3.

The top three short-responses to identified injury causes, solutions, and barriers were categorized through qualitative analysis of company and truck driver responses. Themes were derived from the short-responses and used to categorize the data. The number one cause of overexertion or strain injuries was stated by both companies and truck drivers as loading/unloading freight or lifting heavy or awkward objects. The top solution for these injuries was stated as education, training, or reminders (32% of respondents) for companies, while the top solution stated by truck drivers was getting help or using forklifts and other equipment (17% of respondents). Table 4 lists the top three causes, solutions, and barriers given by company and truck drivers and the percentage listing a theme within the three possible responses.

The most frequently stated cause of slip, trip, or fall injuries by company respondents was not using proper equipment or procedures

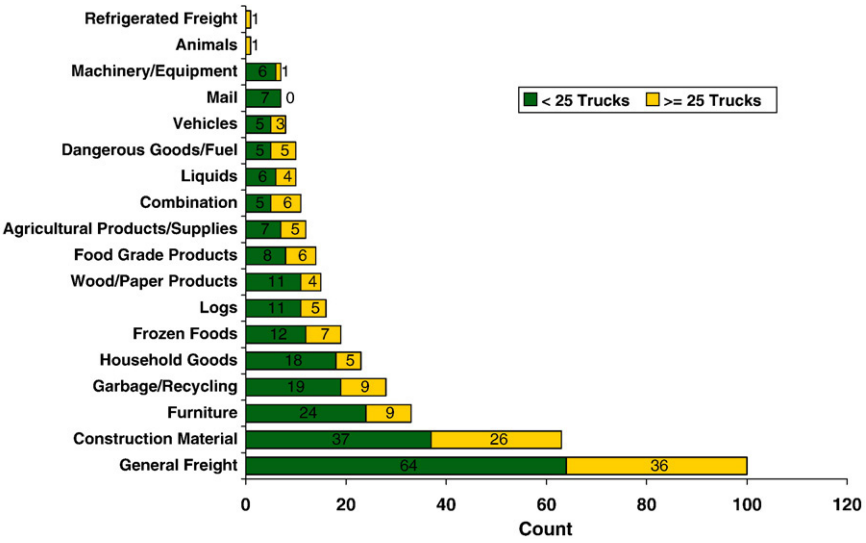

Fig. 1. Number of company survey responses by type of freight normally carried and fleet size.

Table 2
Weighted Rankings of Injury Types by Company Respondents from 1 (Biggest Problem) to 6 (Smallest Problem)

Ranking of Injury Problem	Back, Shoulder, Arm, Hand Overexertion or Strain	Slips, Trips, Falls	Struck Against or By Objects, Persons, Animals	Caught In, Under, or Between	Motor-Vehicle Crash Injuries
1	190	74	10	9	16
2	53	136	29	22	13
3	21	24	58	63	26
4	8	11	72	49	22
5	4	3	19	31	86
6	2	3	4	13	31
Weighted Ranking Sore	423	495	649	671	824

Table 3
Weighted Rankings of Profitability Concerns by Company Respondents from 1 (Biggest Concern) to 9 (Smallest Concern)

Ranking of Profitability Concerns	Fuel Costs	Increasing Costs of Labor, Healthcare, Workers' Compensation	Finding & Keeping Drivers	Government Regulation	Costs of Maintaining or Expanding Facilities & Equipment	Changes in Customer Demands	Competition w/in the Industry	Trucking from Canada & Mexico
1	156	95	44	25	15	8	34	9
2	66	112	42	20	34	9	21	4
3	42	38	51	36	46	19	30	2
4	22	17	38	45	40	28	24	4
5	8	16	41	39	37	34	28	10
6	9	4	22	27	36	35	40	9
7	3	5	13	27	20	57	38	18
8	4	1	7	7	4	15	12	113
9	1	2	1	2	4	2	31	21
Weighted Ranking Score	658	666	926	973	990	1112	1283	1362

Table 4
Top Three Causes, Solutions and Barriers to Solutions for Overexertion or Strain Injuries by Companies and Truck Drivers (% of Respondents)

	Trucking Company Responses (%)	Truck Driver Responses (%)
Top 3 Examples/Scenarios	1) Loading/Unloading Freight, Awkward Lifting (24%)	1) Lifting Objects That Are Too Heavy (21%)
	2) Not Using Proper Equipment or Procedures (21%)	2) Routine Manual Labor of Truck Operation/Delivery (14%)
	3) Tarping, Throwing Wrappers, Securing Straps (17%)	3) Improper Lifting, Pulling, Twisting or Bending (13%)
Top 3 Possible Solutions	1) Education, Training, Reminders (32%)	1) Getting Help/Use Forklift and Proper Equipment (17%)
	2) Planning, Communications, Working as a Team (17%)	2) Equipment Upgrades and Better Maintenance (15%)
	3) Using Proper Techniques, Methods (13%)	3) Slow Down/Don't Overdo It (12%)
Top 3 Barriers to Implementing Solutions	1) Employee Perceptions of Risk/Paying Attention (43%)	1) Common Sense/Driver's Responsibility (16%)
	2) Time and Ability to do Training (12%)	2) Cost of Implementing Controls (13%)
	3) Lack of Ability to Supervise or Control Environment (8%)	3) Time Pressures & Tight Deadlines (12%)

(32% of respondents), while the most frequent cause identified by drivers was slippery ramps and docks (21% of respondents). Both companies and drivers stated that the top solution to these injuries was planning, working as a team, or being careful and aware of surroundings. Companies stated that the top barrier to preventing both overexertion and fall injuries was employee perception of risks and lack of paying attention. Truck drivers reported that the top barrier to prevention is "common sense" or responsibility of the drivers. The causes, solutions, and barriers for fall injuries listed by companies and drivers are presented in Table 5.

Differences in work content between sub-sectors were evaluated by trucking company survey responses detailed in Table 6. Waste Collection (6%) and Moving (8%) reported that less driving was reported being performed at night compared to other sectors. General Freight was the highest, reporting an average of 22% of driving done at night. Lumpers (temporary workers who load and unload freight) were used frequently by Movers (62%) and rarely by Couriers and Messengers (5%) or Waste Collection (8%). Couriers and Messengers reported the highest percentage of temporary workers (27%) compared to the overall industry average reported of less than 1%. Less unionized

Table 5
Top Three Causes, Solutions and Barriers to Solutions for Slip, Trip or Fall Injuries by Companies and Truck Drivers (% of Respondents)

	Trucking Company Responses (%)	Truck Driver Responses (%)
Top 3 Examples/Scenarios	1) Not Using Proper Equipment or Procedures (32%)	1) Slippery Ramps and Docks (21%)
	2) Climbing In/Out and Falling Off Load/Truck (25%)	2) Not Paying Attention Where You Walk (14%)
	3) Weather & Slippery Walking Surfaces (15%)	3) Weather & Slippery Walking Surfaces (13%)
Top 3 Possible Solutions	1) Planning, Getting Help, and Working as a Team (30%)	1) Being Attentive, Careful and Aware of Surroundings (19%)
	2) Slip/Fall Interventions (shoes, surfacing, salt) (23%)	2) Wear Proper Shoes/Watch Your Step (10%)
	3) Education, Training, Reminders (17%)	3) Slow Down/Don't Overdo It (10%)
Top 3 Barriers to Implementing Solutions	1) Employee Perceptions of Risk and Paying Attention (49%)	1) Common Sense/Driver's Responsibility (16%)
	2) Time and Ability to do Training (11%)	2) Cost of Implementing Controls (13%)
	3) Lack of Ability to Supervise or Control Environment (11%)	3) Time Pressures & Tight Deadlines (12%)

Table 6
Company Demographics as Reported by Trucking Industry Sub-sector

	General Freight	Specialized Freight	Waste Collection	Couriers & Messengers	Used Household & Office Goods	Overall
Percentage of driving done at night?*	22 (±18)%	17 (±18)%	6 (±9)%	14 (±18)%	8 (±8)%	17 (±17)%
How many trucks are in your fleet?	54 (±205)	22 (±34)	15 (±16)	23 (±29)	17 (±23)	35 (±143)
Hours per week for non-driver employees?	37 (±13)	36 (±15)	34 (±19)	28 (±17)	34 (±10)	36 (±14)
Hours per week for drivers?*	46 (±10)	48 (±10)	37 (±13)	38 (±6)	40 (±7)	44 (±10)
Percentage who use lumpers to unload cargo?*	27%	13%	8%	5%	62%	27%
Percentage of time drivers spend un/loading cargo?*	19 (±20)%	18 (±19)%	37 (±28)%	22 (±15)%	60 (±27)%	27 (±26)%
Company is unionized?	15%	11%	12%	10%	2%	12%
Percentage of temporary workers?*	0 (±0)%	4 (±16)%	4 (±6)%	27 (±39)%	8 (±18)%	0 (±0)%
Employees regularly work overtime?	41%	60%	48%	38%	51%	47%

* Significant difference ($p<0.05$) between industry sub-sectors.

Table 7
Companies' Reported Sources and Preferences for Obtaining Safety and Health Information

Where do you currently obtain information about occupational safety and health?	Percentage Reporting
Business or trade association	48%
Product vendors	24%
Data searches, books and articles	24%
Private consulting firms	8%
Health care provider	20%
Personnel or training staff	17%
Safety and health committee	17%
Union	3%
WISHA/OSHA	46%
Don't obtain any information	4%
How do you prefer to obtain safety and health information?	
On-site workshops	24%
Off-site training seminars	13%
Email	29%
Written training materials	61%
Videotaped training materials	53%
Train-the-trainer	24%

workers were reported in Used Household & Office Goods moving and in companies with a fleet size of less than 25 trucks. More frequent overtime was reported by companies with a fleet size of 25 trucks or more.

The most frequent source of safety and health information reported by companies was their business or trade association (48%) and WISHA (Washington State OSHA plan)/OSHA (46%). Companies preferred receiving safety and health information as written training materials (61%) and as videotaped training materials (53%). Table 7 details trucking company information sources and preferences for receiving safety information.

The majority of trucking company respondents reported having primary safety program components such as a regularly meeting safety committee (62%), a formal procedure for reporting safety concerns (84%), and a procedure for identifying and controlling safety hazards (87%). Fewer than half reported having safety incentive systems or policies of keeping injured workers on salary. There were significant differences for many elements between companies with small and large fleets. Companies with larger fleets were more likely to have a regularly meeting safety committee, a person with allotted time to safety, an employee incentive system, a policy of

Table 8
Safety Program Elements Reported as Present by Trucking Companies

Safety Program Elements	Fleet Size<25 Trucks	Fleet Size≥25 Trucks	Overall
Has a safety committee that meets regularly?*	57%	75%	62%
Person with time allotted for safety and health?*	71%	89%	75%
Funds dedicated to address unsafe conditions/equipment?	58%	67%	61%
Has a safety incentive system for employees?*	33%	62%	41%
Has a safety incentive system for supervisors?	18%	18%	18%
Policy of keeping injured workers on salary?*	34%	49%	38%
Formal procedure for reporting safety concerns to mgmt?*	80%	92%	84%
Has procedure for identifying and controlling safety hazards?	85%	90%	87%
Provides modified and light-duty jobs for injured workers?*	59%	80%	65%
Top management attends and participates in safety meetings most or all of the time?	70%	64%	68%
Employees are involved in quality improvement most or all of the time?	71%	69%	70%

* Significant difference ($p<0.05$) for companies with fleet size <25 trucks compared to those with ≥25 trucks.

Table 9
Percentage of Truck Driver Ratings of High Perceived Injury Risks by Industry Sub-sector (Ranked ≥4 out of 5)

Injury Risk Factors from 1(low risk) to 5(high risk)	General Freight	Specialized Freight	Waste Collection	Couriers & Messengers	Used Household & Office Goods	Overall
Machines or equipment that you can be caught in , under or between*	27	24	35	22	12	24
Whole-body vibration from driving in the truck	36	36	47	30	38	37
Manually carrying or lifting heavy (>75 lbs), awkward or frequent loads*	21	14	33	46	74	29
Surfaces that you can slip on, trip over or fall from*	38	49	58	44	48	44
Repetitive hand or arm movements*	31	48	77	51	60	49
Activities that require very hard pulling, pushing or gripping*	44	32	68	42	72	46
Equipment or objects that may fall on you or hit you	29	29	37	35	38	31

* Significant difference ($p<0.05$) between industry sub-sectors in ratings of risk.

Table 10
Truck Driver Job Perception and Satisfaction

Job Perception and Satisfaction Elements	Percentage Reporting
Regularly feel pressured to work longer hours	42%
Regularly feel pressured to work faster	40%
Feel mentally exhausted after work most of the time or always	32%
Feel physically exhausted after work most of the time or always	41%
Are either somewhat or very satisfied with their job	86%
Would recommend or strongly recommend their job to someone else	66%
Are either somewhat or very likely to decide to take this job again if looking now	72%
Either agree or strongly agree that the time you devote to your job keeps you from participating equally in household responsibilities and activities	56%

keeping injured workers on salary, a formal procedure for reporting concerns to management, and light-duty jobs for injured workers. Safety program element responses are detailed in Table 8.

The percentage of perceived risks ranked by drivers as four or greater out of a possible five (highest risk) for seven different physical risk factors are presented by industry sub-sector in Table 9. The most frequently reported risk factor was repetitive hand or arm movements at 49% of respondents across sub-sectors, followed by activities requiring hard pushing, pulling, or gripping at 46%. Five physical risk factors showed significant differences in driver responses by sub-sector. The highest reported risk factors by sub-sector were repetitive hand or arm movements by Waste Collection drivers (77% of respondents) and carrying or lifting heavy or awkward loads by Moving drivers (74% of respondents).

The majority (86%) of truck drivers reported being either somewhat or very satisfied with their job, 66% would recommend their job to someone else, and 72% would be either somewhat or very likely to take their job again. A majority (56%) agreed or strongly agreed with the statement that their job time commitments kept them from participating equally in household responsibilities and activities. Table 10 presents descriptive information about the drivers' overall job perceptions and job satisfaction.

Most trucking companies reported very positive safety climate metrics (76%-98%), while truck drivers' reports were lower on average across measures (53%-77%). There were significant differences for all nine measures between company and driver responses. The largest difference was in the expectation that workers would be injured during the next 12 months, for which 2% of companies agreed and 42% of drivers agreed. The average difference between company and truck driver responses to the nine safety climate measures presented in Table 11 was 26%.

4. Discussion

The surveys highlighted differences in perceptions of injury risks, causes, and solutions between companies and drivers. Truck drivers generally reported a lower overall safety climate than did companies. Companies tended to more frequently state that worker behavior was the primary cause of slip, trip, or fall, and other injuries than did the drivers. The drivers more frequently stated that physical conditions such as slippery ramps and docks were the primary injury causes.

Rising fuel costs have been a constant concern to trucking companies but a close second was the rising cost of labor, healthcare, and workers' compensation. This concern of companies highlights the relevance of improving safety conditions within the trucking industry. Improving the safety climate and reducing injury risk factors can affect reductions in workers' compensation insurance and help in reducing labor costs by increasing worker retention and reducing worker absenteeism

Table 11
Company and Truck Driver Responses to Safety Climate Elements

	Trucking Company Responses	Truck Driver Responses
Workers' safety practices are important to the management of my company*	98%	69%
Supervisors and top management seem to care about safety*	97%	68%
Supervisors emphasize safety practices on the job*	97%	67%
Instructions on the safety policies and/or safety requirements are provided to employees*	91%	71%
Regular safety meetings are held for all workers*	76%	53%
Proper equipment is available to do different tasks*	94%	67%
Workers have control over safety on the job*	94%	77%
Taking risks is considered part of the job*	11%	31%
Workers expect they will be involved in an accident or be injured in the next 12 months*	2%	42%

* Significant difference ($p<0.05$) for company responses compared to driver reponses.

(Goggins, Spielholz, & Nothstein, 2008). Company responses to the surveys indicated there is a potential need for innovative and improved educational programs to promote safe behavior and to properly calibrate risk perceptions by drivers. Addressing these issues could have noticeable impacts on trucking companies' productivity and ability to compete in a tightening market.

There were several notable differences in work organization and demographics by sub-sector and fleet size. Factors such as unionization, amount of overtime, use of temporary workers, drivers' responsibilities for unloading cargo, and others can vary significantly between types of trucking companies. Drivers also reported significant differences in perceived exposure to physical risk factors between sub-sectors. This points out the sometimes large differences in work content between types of trucking. These issues should be considered when developing assessment and control strategies in the trucking industry.

There are relatively large differences overall between companies' and drivers' perceptions of safety climate elements. This could point to safety program elements and communication strategies to help the industry improve employee perception of safety. The majority of drivers did report positive job satisfaction, however, a large percentage of workers reported issues or work-related stress and work-family conflict. These results highlight important possible contributing and confounding factors to consider within the sector.

The survey findings do appear generalizable to the Washington State trucking industry, and likely much of the U.S. sub-sector, however there were several limitations in the current study. Obtaining a valid sample of truck drivers using standard survey techniques was challenging. The majority of the sample obtained from current license information was disqualified because of either an invalid address or phone number. This may be in part due to the increase in use of cellular phones, which are not associated with the address in a directory look-up. This was a known challenge, though there was not a systematic difference in the employer NAICS distribution between truck drivers who responded and those disqualified. The survey respondents are likely a representative sample of truck drivers in the Washington State trucking industry.

Another limitation was that the survey of trucking companies excluded those with less than 5 FTE, which eliminated the smallest employers, and potentially largest proportion of trucking companies in Washington State. This was a decision made to increase the quality of the administrative data used to generate the survey sample. It was felt that this was necessary, based on previous survey experience, to obtain valid company information. The population of companies in trucking with one or two employees is a large and important part of the small businesses within the industry and should be considered for future assessment of their specific needs.

A further limitation that must be recognized is the lack of ability to match employees with specific employers. It is possible, though highly unlikely, that the respondents of both surveys represented largely the same population of organizations. Identifying specific company employment for drivers was not possible because the sample of survey recipients was taken from a database of commercial drivers license holders, which did not contain that data.

The findings from this work are being used by SHARP to help provide the Washington State trucking industry with resources to decrease hazards associated with common occupational injuries. Research on the national level is needed to determine regional differences in needs and to further differentiate the needs of long-haul drivers, loading dock, and other workers within the industry. Development and evaluation of both physical and organizational interventions to reduce injuries in trucking may help to decrease work-related morbidity in this high-risk industry.

The survey findings point to the need for systematic interventions to control the risks of work-related musculoskeletal disorders (WMSDs) and slip, trip, or fall injuries in the trucking industry. These were ranked as the top two types of injuries by both employers and drivers, which matches the history of compensable workers' compensation claims in Washington State (Bonauto et al., 2006). Implementation of engineering controls for material handling would address the most frequently reported cause of WMSDs. Regular hazard identification and control are also needed to address slip, trip, and fall injuries in trucking. Implementation of organizational-level changes addressing company processes may also provide an opportunity for improvements in the industry.

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