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Narrative and quantitative analyses of workers' compensation-covered injuries in short-haul vs. long-haul trucking

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Trucking remains one of the most dangerous industries in the U.S. Study aims were to (1) identify differences in worker injury types; (2) describe typical injury scenarios; and (3) recommend injury control measures, in short-haul vs. long-haul trucking. Narrative text analyses of Kentucky short-haul and long-haul trucking workers' compensation first reports of injury were performed. A higher percentage of lifting and cranking injuries were identified in short-haul trucking compared with long-haul trucking that had a higher percentage of securing/opening/closing/adjusting injuries that involved tarping, trailer door handling, and cab slippage. In contrast, a higher proportion of short-haul trucking injury scenarios involved roadway departures and rear-end collisions. Study findings can be used to inform intrastate vs. interstate trucking injury prevention control strategies such as an enhanced driver safety training and safe freight handling in short-haul trucking, and tarping, trailer safety, and cab safety in long-haul trucking.

Keywords: Injury scenarios; long-haul; short-haul

Introduction

The truck transportation industry continues to have one of the highest occupational injury and illness rates in the United States, resulting in a tremendous burden of workers' compensation costs on employers (Bonauto, Silverstein, Adams, & Foley, 2006; Leigh, Waehrer, Miller, & Keenan, 2004). The Bureau of Labor Statistics (BLS) reported a non-fatal injury rate of 4.5 injuries per 100 workers in truck transportation compared to the national rate of 3.4 per 100 workers for all industries combined (BLS, 2013a) in 2012. The injury rate resulting in days away from work, job transfer, or job restriction was 3 per 100 truck transportation workers, nearly two times higher than the rate for all industries; fatal injuries numbered 500 in 2012 (BLS, 2013b).

While a typical work day for a trucker involves long driving times, additional repetitive activities put them at an increased risk for injuries, including entering and exiting the cab, working from heights on trailers, physically moving cargo, coupling and uncoupling trailers, and securing loads. Studies have shown that the majority of trucker injuries result from non-motor vehicle collision incidents, and mostly affect the neck, back, and upper extremities (Friswell & Williamson, 2010; Smith & Williams, 2014). In a Washington State study, Smith

and Williams (2014) found that trucking injuries differed based on sector and occupation, and falls from elevation and musculoskeletal injuries accounted for some of the highest median workers' compensation claims and medical costs, in alignment with BLS survey findings where one-third of trucking injuries were due to overexertion, and over one-quarter were due to falls, slips, and trips (BLS, 2013b). Injuries involving freight loading and mechanical work are also frequently reported (Smith & Williams, 2014).

Trucking-related musculoskeletal disorders could be exacerbated by the lack of regular health care visits and existing injuries. In a cross-sectional survey of 316 US long-haul truckers, 70% had no regular health care visits and 42% had musculoskeletal disorders. Of those who sought medical attention, 20% waited until they were home to do so (Apostolopoulos, Sönmez, Shattell, Gonzales, & Fehrenbacher, 2013), which could prolong needed treatment and healing.

Falls from trucks may result in significant injuries and lengthy periods of time spent away from work. A study of commercial truck drivers in Ontario identified three locations where truckers were most likely to fall from an elevated height: the back of the trailer, the truck step, and the cargo being transported (Jones & Switzer-McIntyre, 2003).

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Of the 352 workers in the study, 24% sustained multiple injuries, including sprains and strains, contusions, and fractures. Non-driver workers such as cargo loaders and truck maintenance personnel are also at risk for falls.

While not the most prevalent cause of injury, motor vehicle incidents still account for large percentages and numbers of worker injuries in truck transportation. The National Highway Traffic Safety Administration (NHTSA) reported that 104,000 people were injured in crashes involving large trucks in 2012, an increase of 18% from the previous year. Of those injured, 24% were occupants of large trucks and 9% of the injuries resulted from single-vehicle crashes (NHTSA, 2014). A study by Bunn, Slavova, and Robertson (2013) found that during a moving semi-truck collision, the odds of an injury were 2.25 times more elevated for both drivers and sleeper berth passengers who did not use safety restraints compared to those who used occupant restraints.

Few studies have utilized workers' compensation data to examine occupational-related injury types in the truck transportation industry (Bonauto *et al.* 2006; Smith & Williams, 2014). Narrative text analysis of workers' compensation first reports of injury (FROIs) can provide a more detailed analysis of injury types and inform injury prevention strategies (Brooks, 2008; Shibuya, Cleal, & Kines, 2010). Shibuya *et al.* (2010) analysed one company's truck driver accident descriptions but to our knowledge, no studies have analysed workers' compensation FROI narrative text descriptions to compare long-haul transportation and short-haul transportation worker injury scenarios. The aims of this study were to (1) identify and characterize differences in worker injury types between short-haul and long-haul trucking; (2) describe typical short-haul and long-haul trucking injury scenarios; and (3) develop short-haul and long-haul trucking injury prevention recommendations based on the typical injury scenarios identified.

Materials and methods

Study data

All employers in Kentucky with one or more employees are required to have workers' compensation coverage for their workers. Agricultural workers are exempt from this coverage but may elect coverage. Kentucky Revised Statute 342.038 requires employee FROIs (at least *one* day missed work) to be reported by the employer to its workers' compensation insurance carrier within three working days of incident notification, and by the employer's insurance carrier to the Department of Workers' Claims within one week of receiving notification. Workers' compensation FROI data contain several coded variables, as well as descriptive free-text narrative fields that describe the injury scenarios in greater detail. Kentucky workers'

compensation FROIs submitted in 2012 were obtained for the truck transportation industry from the Kentucky Department of Workers' Claims (KDWC). This study was part of the Kentucky Occupational Safety and Health Surveillance Program, and was approved by the University of Kentucky Institutional Review Board.

Study population and selection criteria

Short-haul trucking is typically defined as operating within a radius of 150 miles or less, and long-haul trucking is defined as operating within a radius of more than 250 miles (Urban Insurance Agency, 2014). Cases within the workers' compensation database were industry-coded with either a Standard Industrial Classification (SIC) code or a North American Industrial Classification System (NAICS) code. The KDWC recommends the use of NAICS industry coding by data submitters but NAICS coding is not required. Therefore, the data-set contained individual records coded with either an NAICS or an SIC industry code.

Short-haul truck transportation cases were selected using the following industry codes: (1) SIC 4212 - local trucking, without storage; (2) SIC 4214 - local trucking and storage; (3) NAICS 484110 - general freight trucking, local; and (4) NAICS 484220 - specialized freight (except used goods) trucking, local. Long-haul truck transportation industry cases were obtained using the following selection criteria: (1) SIC 4213 - trucking, except local; (2) NAICS 484121 - general freight trucking, long-distance, truckload; (3) NAICS 484122 - general freight trucking, long distance, less than truckload; and (4) NAICS 484230 - specialized freight (except used goods) trucking, long-distance. NAICS code 484210 - used household and office goods moving, contained 16 cases that were excluded from the study, since short-haul or long-haul trucking could not be identified. The total number of final cases for the study was 739.

Narrative text field analysis

An analysis of the FROI free-text narrative field was conducted to better understand the worker's activity at the time of injury. Four narrative activity variables were designed based on the most common activities found in the narrative fields. 'Lifting/cranking' activities required the claimant to exert force such as lifting freight or heavy items, or manually operating a crank. Lifting and cranking activities were grouped together based upon the primary engagement of the extremities and the back, which are under varying degrees of force and tension depending on weight of the load and stiffness of the crank. 'Securing/opening/closing/adjusting' required the worker to exert force by securing, opening, closing, or adjusting a component of the truck or load. 'Truck operation' included all events that took place while driving the truck.

'Manoeuvring into/out of truck cab' grouped all instances in which the driver was entering or exiting the cab or trailer at the time of injury. If there were <5 cases for specific injury activities that did not fall within any of the above categories, then those cases were grouped together in the 'other' category. There were insufficient narrative text descriptions for 45 (16%) of the short-haul trucking FROIs and 109 (24%) of the long-haul trucking FROIs so these cases were added to the 'other' category as well.

Groupings of injured body parts and nature of injury

The body part, cause of injury, and nature of injury codes were available in the FROIs and defined by KDWC's 'Kentucky's Detailed Codes & Definitions Manual' that uses the International Association of Industrial Accident Boards and Commissions coding framework. Injured body parts were categorized into six groups: (1) upper extremities; (2) lower extremities; (3) back; (4) multiple body parts; (5) other soft tissue and organs; and (6) 'other'.

Data analysis

Frequencies were determined for demographic characteristics (age and gender), occupation, exposure (e.g. length of time between hire date and injury date, pre-injury activity), and injury outcome (e.g. injured body part, nature of injury, cause of injury, award disposition) variables. Chi-square tests were performed to assess the significance of the differences among the trucking groups on the above variables. Statistical analysis was performed using Epi Info™ 7.

Injury activity scenarios

The most common injury activity scenarios were identified for short-haul and long-haul truck transportation. For each of the top three activities in each trucking industry group, the 10 most common activity scenarios representing all occupations in each trucking group were selected and described. A specific narrative text analysis was also performed for the truck driver occupation alone within the short-haul and long-haul trucking groups.

Results

Demographics

Table 1 shows the distribution of cases for both trucking groups by demographic characteristics. There were 284 cases in the short-haul trucking group and 455 cases in the long-haul trucking group. There were less than five fatalities in the total number of cases ($n = 739$). The majority of workers in both trucking groups were male (95% short-haul vs. 92% long-haul). Chi-square results indicate that

the age distribution of injured long-haul trucking workers is different from the age distribution of the short-haul trucking workers ($p = .021$). The main difference was a significantly higher proportion of younger workers, 19–24 years of age in injured short-haul trucking workers (8%) compared to 19–24 year old long-haul trucking workers (3%) ($p = 0.004$). If this age group was excluded from the analysis, the age distribution between the two industry sectors was not statistically significant ($p = 0.27$). The highest proportion of injuries in both trucking groups occurred in the 45–54 age groups (34% short-haul, 32% long-haul). There was no significant difference in the percentage of injured workers who were 65 years or older, between the two trucking groups ($p = 0.18$).

The distribution of job tenure length differed between sectors ($p = 0.049$). A logistic regression model was used to assess which job tenure length contributes the most to the difference in the distribution of tenures across the two sectors. The odds ratio for short-haul employees was significantly higher for an injured employee in the trucking industry with tenure less than 30 days on the job vs. one to six months on the job (OR = 2.4, 95% CI = [1.2, 5.1]), vs. six months to one year on the job (OR = 2.5, 95% CI = [1.2, 5.4]), and vs. one to three years (OR = 2.2, 95% CI = [1.1, 4.4]), but no significant difference with tenure more than three years (OR = 1.5, 95% CI = [0.8, 3.0]) (data not shown). It should be noted that there were injury reporting differences between long-haul and short-haul trucking FROIs on job tenure length; there were 89 missing values for short-haul trucking FROIs (31%) and 71 missing values for long-haul trucking FROIs (16%). Due to the large proportion of missing values (22% of the study sample), inference related to association between job tenure length, and short-haul vs. long-haul sectors could be subject to bias and should be further investigated.

Short-haul trucking cases were primarily identified with two codes: SIC code 4212 - local, without storage (49%) and NAICS code 484110 - general freight, local (42%). The majority of long-haul trucking injury cases were identified using SIC code 4213 - trucking, except local (75%); 25% were identified using NAICS codes for general freight, long distance, truckload, and less than truckload. Truck drivers were the leading occupation for both long-haul and short-haul truck transportation FROIs; there was a significantly higher percentage of long-haul truck driver FROIs compared to short-haul truck driver FROIs (69% vs. 57%, respectively; $p = 0.0006$). Conversely, there was a higher percentage of labourer FROIs within short-haul trucking compared to long-haul trucking (15% vs. 7%, respectively; $p = 0.0014$).

Injury characteristics

A higher percentage of short-haul trucking injury scenarios involved 'lifting/cranking' (31% short-haul vs. 24%

Table 1. Demographic characteristics of short-haul vs. long-haul trucking injuries, 2012.

Demographic characteristic	Short-haul trucking	Long-haul trucking	<i>p</i> -value ^a
Gender ^b	<i>n</i> = 284	<i>n</i> = 455	
Male	270 (95%)	420 (92%)	0.142
Female	14 (5%)	35 (8%)	
Age ^b			
19–24	22 (8%)	14 (3%)	0.021
25–34	33 (12%)	67 (15%)	
35–44	64 (23%)	129 (28%)	
45–54	97 (34%)	146 (32%)	
55–64	57 (20%)	89 (20%)	
65+	11 (4%)	10 (2%)	
Average age	45.51	45.37	
Length of time between hire and injury ^b			
<30 days	20 (10%)	21 (6%)	0.049
≥1 month <6 months	31 (16%)	79 (21%)	
≥6 months ≤1 year	24 (12%)	63 (16%)	
>1 year ≤3 years	40 (21%)	91 (24%)	
>3 years	80 (41%)	130 (34%)	
Missing values	89	71	
Trucking industry ^b			
4212 - local, without storage	139 (49%)	0 (0%)	
4213 - trucking, except local	0 (0%)	339 (75%)	
4214 - local and storage	16 (6%)	0 (0%)	
484110 - general freight, local	119 (42%)	0 (0%)	
484121 - general freight, long distance, truckload	0 (0%)	57 (13%)	
484122 - general freight, long distance, less than truckload	0 (0%)	54 (12%)	
484220 - specialized freight, local	10 (4%)	0 (0%)	
484230 - specialized freight, long distance	0 (0%)	5 (1%)	
Occupation ^b			
Truck drivers, heavy and light	162 (57%)	316 (69%)	0.006
Unknown	53 (19%)	64 (14%)	
Labourer	42 (15%)	34 (7%)	
Mechanic	12 (4%)	17 (4%)	
Administrative/managerial	8 (3%)	10 (2%)	
Other	7 (2%)	14 (3%)	

^aChi-square test.

^bGender, age, length of time between hire and injury, trucking industry, and occupational categories were based on existing available codes within FROI data.

long-haul) and ‘truck operation’ (15% short-haul vs. 9% long-haul) (Table 2). Long-haul trucking injury scenarios more frequently involved ‘securing/opening/closing/adjusting activities’ (28% long-haul vs. 20% short-haul). Twenty-five (9%) of the short-haul trucking cases and 70 (15%) of the long-haul trucking cases did not contain sufficient injury activity descriptions to determine the specific activity that resulted in injury. The top three causes of injury for both trucking groups were strains, motor vehicle collisions, and falls, slips, or trips. There was a higher proportion of short-haul trucking motor vehicle injuries compared to long-haul trucking motor vehicle injuries (17% short-haul vs. 13% long-haul, *p*-value = 0.109). Within the short-haul

trucking group, upper extremities were more frequently injured (25%). Among the long-haul trucking group, lower extremities were more frequently injured (27%).

‘Sprain/strain/tear’ injuries accounted for the highest numbers in both trucking groups (52% in long-haul trucking vs. 45% in short-haul). Six long-haul trucking FROIs identified brain injuries; no brain injuries were identified in short-haul trucking FROIs.

Award disposition and award period

There was no significant difference between long-haul and short-haul truck transportation groups in regard to

Table 2. Injury characteristics of short-haul vs. long-haul trucking, 2012.

Injury characteristic	Short-haul trucking	Long-haul trucking	<i>p</i> -value ^a
Injury activity ^b	<i>n</i> = 284	<i>n</i> = 455	
Lifting/cranking	88 (31%)	110 (24%)	0.001
Securing/opening/closing/adjusting	56 (20%)	127 (28%)	
Truck operation	43 (15%)	42 (9%)	
Manoeuvring into/out of truck cab	34 (12%)	45 (10%)	
Other activity not specified above	38 (13%)	61 (13%)	
Activity unknown/insufficient information	25 (9%)	70 (15%)	
Top causes of injury ^c			
Strain	103 (36%)	158 (35%)	0.318
Fall, slip, or trip	57 (20%)	101 (22%)	
Motor vehicle	49 (17%)	59 (13%)	
All other	75 (26%)	137 (30%)	
Injured body part ^c			
Upper extremities	71 (25%)	113 (25%)	0.529
Lower extremities	60 (21%)	123 (27%)	
Back	57 (20%)	81 (18%)	
Multiple body parts	43 (15%)	67 (15%)	
Other soft tissue and organs	24 (8%)	35 (8%)	
Other	29 (10%)	36 (8%)	
Nature of injury ^c			
Sprain/strain/tear	127 (45%)	236 (52%)	0.294
Other	74 (26%)	106 (23%)	
Contusion	34 (12%)	51 (11%)	
Fracture	25 (9%)	36 (8%)	
Multiple injuries	24 (8%)	26 (6%)	

^aChi-square test.

^bInjury activity categories were developed by the authors through narrative text analysis.

^cCause of injury, injured body part, and nature of injury categories were based on existing available codes within FROI data.

workers' compensation award disposition (data not shown). Equivalent percentages of both long-haul trucking and short-haul trucking workers did not receive any workers' compensation benefits (~76%) on their FROIs. Eight per cent of the short-haul trucking FROIs resulted in one-time payments and <1% resulted in monthly or weekly awards. For the long-haul truck transportation group, 5% of the FROIs resulted in one-time payments and approximately 1% resulted in monthly or weekly awards.

Injury activity scenarios

The majority of short-haul and long-haul trucking injury activity scenarios involved (1) freight moving in the 'lifting/cranking' category; and (2) tarping the trailer, and handling the trailer door in the 'securing/opening/closing/adjusting' category (Tables 3 and 4). Within short-haul trucking, many injury scenarios also included leaving the roadway and rear-end collisions in the 'truck operation' category (Table 5). Also, of the 22 short-haul trucking workers who were 19–24 year old in, 12 (55%) were labourers and 10 (45%) were moving freight when the

injury occurred. In the long-haul trucking industry, many worker injury scenarios involved knee hyperextensions when exiting the cab and slipping while entering and exiting the cab (Table 6).

When reviewing truck driver scenarios alone, the top three short-haul truck driver injury scenarios involved (1) 'operating the truck'; (2) 'lifting/cranking'; and (3) 'manoeuvring into/out of truck cab' (Table 5). The most common truck driver injury scenarios in the 'operating truck' text narratives were losing control of the truck, being struck by another vehicle from behind, and musculoskeletal injuries associated with extended routine driving. The most common truck driver injury scenarios in the 'lifting/cranking' narratives were lifting cargo or other items, lifting the ramp to the trailer, and adjusting the crank when connecting the dolly to the truck. 'Manoeuvring into/out of truck cab' short-haul truck driver injuries involved slipping, tripping, or mis-stepping as they entered or exited the cab, and falling as they entered or exited the trailer.

The top three long-haul truck driver injury scenarios involved (1) 'securing/opening/closing/adjusting'; (2) 'lifting/cranking'; and (3) manoeuvring into/out of truck

Table 3. Top injury scenario activities for all occupations in short-haul trucking, 2012.^a

1. Lifting/cranking (<i>n</i> = 88, 31%)	
■	‘Employee was putting carrier housing in truck, strained small part of back’
■	‘He was lifting a driveshaft from a truck and felt pain in his right lower stomach’
■	‘While lifting gallon jug up to fill engine oil, felt pain in his right shoulder’
■	‘Employee unloading cabinets off a truck. Felt strain in lower back right leg after activity’
■	‘Carrying merchandise onto truck and mis-stepped between truck and dock plate’
■	‘He was pulling on a pallet of freight when he felt pain in his lower back’
■	‘He was unloading freight from a trailer and strained his back’
■	‘Back pain – he said he was picking up an oil line and felt something pull in back’
■	‘He was pulling 8-foot-long crates from the nose of his trailer’
■	‘Injured worker was pulling on something and felt a pain in his abdomen’
2. Securing/opening/closing/adjusting (<i>n</i> = 56, 20%)	
■	‘The injured worker experienced right shoulder pain while he was cranking tarp cover off a loaded trailer’
■	‘The ratchet slipped – his knee went one way and his foot went another’
■	‘Pulling a chain to secure a coil on a flatbed tractor trailer when the chain gave away causing him to fall off the trailer’
■	‘Wrist-tarpping truck, fell getting down and caught fall with wrist’
■	‘Contusions/left shoulder, ribs, back. Fell when strapping down truck’
■	‘On back of truck checking tarp and fell off truck’
■	‘Strained abdomen while closing door on trailer’
■	‘He dropped trailer and went to next stop/bent over to open trailer door, experiencing neck pain’
■	‘He was pulling his lift gate when his foot slipped off the bumper and he fell. He tried to catch himself and hurt his left wrist’
■	‘Upon entering quarry, employee entered safe zone, exited truck, went to rear of truck and proceeded to pull tailgate to remove debris and heard shoulder pop’
3. Operating truck (<i>n</i> = 43, 15%)	
■	‘Employee drove company vehicle head-on into a tree at a speed less than 40 mph causing trauma and minor cuts to his body from impact’
■	‘Trunk, pelvis sprain/employee was driving, the spring hanger broke and truck veered to side of road’
■	‘Soreness, upset stomach – drove on soft shoulder, and overturned’
■	‘Motor vehicle accident when employee hit guardrail’
■	‘Multiple/rear-ended by other driver’
■	‘Multiple/head, right hand/rear-ended by other vehicle’
■	‘Restrained driver. Injured worker states he saw a vehicle coming up behind him and he tried to pull over to the side of road but was struck from behind’
■	‘Multiple contusions on arms, legs, chest, and shoulder while driving on a narrow road. The truck slipped off the edge of the road causing the truck to turn on its side’
■	‘Neck strain after the employee pulled out in front of another vehicle’
■	‘Leaving strip job loaded with coal. Going uphill and truck rolled back and turned over’

^aInjury scenario activity categories were developed by the authors through narrative text analysis.

cab (Table 6). Many long-haul truck drivers were injured while (1) handling the trailer door or tarping their load in the ‘securing/opening/closing/adjusting’ category; (2) physically handling freight and operating a dolly in the ‘lifting/cranking’ category, and (3) slipping, tripping, or falling from the cab steps and injuring the head or knee in the ‘manoeuvring into/out of truck cab’ category.

Discussion

Although many studies have been conducted on truck transportation industry injuries, this is the first study, to the authors’ knowledge, of workers’ compensation FROI text analyses to describe and identify differences between

short-haul and long-haul trucking injuries. Trucking injury rates could not be calculated since short-haul and long-haul industry employment denominator numbers were not available by SIC industry code; workers’ compensation FROIs used in this study were coded with either SIC or NAICS codes (not both). NAICS widely replaced SIC coding in 1997 and, therefore, all truck transportation industry employment data are only reported by NAICS codes. The majority of cases in both trucking groups in this study were coded with only SIC codes (55% in short-haul, 75% in long-haul). We were unable to accurately crosswalk SIC codes to NAICS codes due to insufficient information necessary to identify long-haul vs. short-haul subtypes.

Table 4. Top injury scenarios for all occupations in long-haul trucking, 2012.^a

1. Securing/opening/closing/adjusting (<i>n</i> = 127)	
■	‘Pulling tarp on a load for 200 ft and pulled muscle from neck down to fingers’
■	‘Pushing rolling cover over and hurt lower back’
■	‘Employee tightened straps down to secure load, and suffered a right shoulder sprain’
■	‘Releasing load strap, felt pop in shoulder/right shoulder acute strain’
■	‘Employee was walking between skids on his trailer. His foot got stuck and he fell between’
■	‘Pulled on tool box and handle came off causing employee to lose balance and fall off trailer’
■	‘Employee hurt right shoulder while trying to close trailer doors’
■	‘Raising trailer door up and felt pop and pain in shoulder’
■	‘Employee states he was closing hood of his truck when he stepped on a rock in the gravelled parking lot and twisted his ankle causing pain’
■	‘He was pulling the fifth wheel pin release and pulled a muscle in his right forearm’
2. Lifting/cranking (<i>n</i> = 110)	
■	‘Employee bent over to pick up a ramp end that is approximately 75 lbs and his back popped at that time’
■	‘Picked up a deck board inside a trailer to put on a rack when he felt something in his right arm pull’
■	‘Employee strained his back from repetitive lifting of packages’
■	‘Injured worker picked up a tyre from the floor and felt a pop in his right elbow’
■	‘While restacking a skid of freight, the employee felt pain and a pull in the groin’
■	‘Claimant states that he was lowering dolly legs on the trailer and the dolly crank was very hard which injured his right shoulder/arm’
■	‘Felt pull in back while cranking down trailer/back strain’
■	‘Driver squatted down to hook up a hose and felt severe pain in left knee’
■	‘Employee sustained a hernia to stomach area while lifting’
■	‘Employee sustained a strain to low back while lifting’
3. Manoeuvring into/out of cab or trailer (<i>n</i> = 47)	
■	‘Slipped off top step of tractor and fell to the ground landing wrong on left foot’
■	‘He was stepping out of his truck and his left leg gave out; his knee buckled’
■	‘Employee was getting out of truck, he missed the hand grip on the side and fell backwards’
■	‘Climbing out of truck and hyperextended knee’
■	‘Employee mis-stepped while getting off truck and hyperextended left knee’
■	‘Claimant states that he slipped entering the truck and fell backwards hitting his head on the ground’
■	‘Slipped and fell getting out of truck/ankle sprain’
■	‘Climbing out of back of semi-trailer, stepping down, slipped and fell to the ground. Upper left leg strain’
■	‘Pulled self while climbing into truck bed’
■	‘Claimant states that he was attempting to enter the trailer and slipped’

^aInjury activity categories were developed by the authors through narrative text analysis.

Most short-haul and long-haul trucking injuries were in males, consistent with other studies on trucking injuries (Bunn, Slavova, & Tang, 2011; Jones & Switzer-McIntyre, 2003; Smith & Williams, 2014). The gender disparity is likely due to the fact that the vast majority of drivers employed in the trucking industry are male (US Census Bureau, 2010). For both trucking groups, the highest proportion of FROIs was for workers employed more than three years. This difference was proportionately higher for the short-haul trucking group (41%) than for the long-haul trucking group (34%). These results suggest that initial and annual refresher worker safety training might be beneficial in short-haul trucking.

The narrative text analysis identified a high number of short-haul trucking group motor vehicle-related FROIs due to roadway departure and rear-end collisions. Half of

the injured short-haul workers were employed in the local trucking without storage industry (SIC code 4212) defined as ‘furnishing trucking ... in a single municipality, contiguous municipalities, or a municipality and its suburban areas’. Driving in more heavily congested urban traffic areas may increase short-haul truck drivers’ odds for being involved in a motor vehicle incident. Common contributing factors described in text narratives were speeding, vehicle defect, and inattention. Intrastate drivers require less rigorous licensing and vehicle inspection processes compared to interstate drivers. While the Federal Motor Carrier Safety Administration (FMCSA) sets licensing, and vehicle inspection standards for interstate truck transportation, intrastate trucking regulations are set by the state in which the truck operates. States may deviate from the FMCSA standards by requiring less strict

Table 5. Top injury scenarios for short-haul truck drivers, 2012.^a

1. Operating truck (<i>n</i> = 39, 24%)	
■	‘Driver was in left lane when a lady passed him, lost control of her car and spun into the trailer’
■	‘He was involved in a single-vehicle accident. Ran off road and the truck jack-knifed’
■	‘Driving the truck downhill when the truck slipped due to the ground being so muddy’
■	‘Turned rig over while turning into customer’s location’
■	‘Employee stated that his ankle just started hurting while he was driving, and he didn’t know how or when it was injured’
■	‘Employee states that he sat in the truck from Sunday to Thursday and his back started hurting’
■	‘Right shoulder strain. Employee was driving a truck and hit a light pole going approximately 5 mph’
■	‘Neck strain. Employee pulled out in front of another vehicle’
■	‘Saw truck coming up behind him, tried to pull over to side of road and was struck from behind’
■	‘Multiple, head and right hand. Rear-ended by other vehicle’
2. Lifting/cranking (<i>n</i> = 39, 24%)	
■	‘Employee was lifting ramp onto trailer when he felt a sharp pain in his back’
■	‘Unloading. Delivering a large entry door and the weight of the door cause his back to hurt’
■	‘Was loading unit when he slipped on gravel and pulled left hamstring’
■	‘Employee was loading unit and going in and out when he felt pain from twisting, etc.’
■	‘Employee unloading cabinets off a truck. Felt strain in lower back and right leg after activity’
■	‘Low back injury. Employee was loading cars, lifted the ramp attached to the trailer and felt a pull in his lower back’
■	‘Employee was pushing his skid ramps on his trailer and felt pain in his low back’
■	‘Employee was lifting ramp, stood up, walked a few steps and felt pain’
■	‘Turning crank on trailer and hurt back’
■	‘He was cranking the dolly on his trailer and strained his abdomen’
3. Manoeuvring into/out of cab or trailer (<i>n</i> = 28, 17%)	
■	‘Driver was getting out of truck and lost his balance causing him to fall. He tried to catch himself with his hands and fractured his wrist’
■	‘Driver was exiting tractor and strained his right knee’
■	‘Right knee injury. Employee stepped out of truck onto step and his foot got stuck. He turned and felt his knee pop’
■	‘Employee exiting cab with mud on his shoes; he slipped and reached to grab causing sprains to right elbow and right rotator cuff’
■	‘Bilateral hand contusions and swelling. Employee was exiting trailer and he tripped over a chain, falling on both hands onto the concrete’
■	‘Injured worker was climbing out of tractor and it was dark so the driver stepped into a hole in the parking lot which caused him to twist his left ankle’
■	‘Injured worker was getting off of his truck, slipped on the truck stairs and fell onto the pavement’
■	‘Twisted hip & back – fell getting out of truck to get lunch’
■	‘Contusion/strain to left wrist, right knee and right hip: employee fell while getting off side of trailer, tripped and fell about 1 foot to the ground’
■	‘While climbing into trailer portion of truck, injured worker fell and struck head causing a concussion’

^aInjury activity categories were developed by the authors through narrative text analysis.

medical qualifications, lowering driver age restrictions, or lengthening driver hours per week. In 2012, Kentucky intrastate drivers were allowed to drive 82 hours per week compared to the 70 hours per week maximum set by the FMCSA for interstate drivers. A high proportion of FROIs involved 19–24 year olds in the short-haul trucking group, who were mostly labourers performing freight handling activities. These results indicate that young workers in the short-haul trucking group may benefit from new and refresher freight handling safety training, employer policies on standard driving hours, and defensive driving training in congested traffic areas. Also, young short-haul trucking workers may benefit from worker safety trainings

focused on safe freight handling procedures, and access to proper freight-moving equipment.

Many long-haul trucking injuries involved trailer tarping and handling the trailer door. Long-haul trucker text narratives frequently described manually adjusting tarps on their loads, which often results in falls and strains due to carrying the heavy tarps while climbing to the top of the load. Tarping injury prevention controls involve scaffolding and harness systems for fall prevention safety. Loading dock scaffolding systems, portable and automatic tarping systems, and ladders may help prevent injuries associated with tarping. Trailer door opening injuries may be reduced by controls such as remote control trailer door openers.

Table 6. Top injury scenarios for long-haul truck drivers, 2012.^a

1. Securing/opening/closing/adjusting (<i>n</i> = 93, 29%)	
■	‘Opening trailer doors and a load of tyres fell on her’
■	‘Employee hurt right shoulder while trying to close trailer doors’
■	‘Injured worker was closing trailer door and right hand caught in hinge causing fracture’
■	‘Shoulder strain/employee forcefully closed trailer door with shoulder and felt pain after’
■	‘Injured worker was loosening a strap on the truck, he slipped and fell and hurt left hand’
■	‘Fell and hit trailer while tarping trailer/right shoulder strain’
■	‘On the trailer strapping a load and the strap was hung up and when he pulled, it came loose and he fell backwards to the ground, injuring his left knee’
■	‘Employee was tightening bungies when one broke, knocking the employee off the truck and causing a head injury’
2. Lifting/cranking (<i>n</i> = 57, 18%)	
■	‘Cranking landing gear on the trailer and was struck in nose by the handle’
■	‘Was cranking landing gear on trailer up and it sprang back and struck her in the face’
■	‘EE strained back from repetitive lifting of packages’
■	‘Employee was unloading trailer causing back pain’
■	‘While moving skids with a pallet jack injured neck and right shoulder’
■	‘Using dolly to take refrigerator up stairs. Turned to check stair and felt pop in left hip’
■	‘Picked up a deck board inside a trailer to put on a rack when he felt something in his right arm pull’
■	‘A construction worker and I were pushing their freight to the back of the trailer and my foot slipped’
■	‘Injured worker squatted to pick up trash in trailer and strained his right knee’
■	‘Cranking down dolly legs on trailer. Strained mid-low back while cranking’
3. Manoeuvring into/out of truck cab (<i>n</i> = 44, 14%)	
■	‘Fell while climbing out of truck. Right shoulder strain’
■	‘Struck left knee on truck step when climbing into cab. Left knee contusion’
■	‘Claims the weather was rainy. He stepped up quickly into the cab and slipped’
■	‘Strain right shoulder. Employee tripped while exiting truck, grabbed seatbelt to break his fall, and felt pull in shoulder’
■	‘Driver fell out of his truck suffering multiple contusions’
■	‘Employee alleges getting in and out of truck caused knee pain’
■	‘Claimant states that he slipped while entering truck and fell backwards hitting his head on the ground’
■	‘Alleged knee sprain. Employee reached down to exit truck and twisted knee’
■	‘The claimant was climbing down from the truck when he slipped, fell and hit his head’
■	‘Claimant slipped while exiting his truck and injured his leg’

^aInjury activity categories were developed by the authors through narrative text analysis.

For both trucking groups, strains and falls, slips, and trips were leading injury types. Smith and Williams (2014) found that musculoskeletal disorders of the neck, back, and upper extremities were the most commonly reported injuries among trucking industry workers’ compensation claims in Washington State over a five-year period. Spielholz et al. (2008) found that of 359 trucking companies and 397 commercial drivers surveyed, both trucking companies and drivers ranked musculoskeletal and slip, trip, and fall injuries as the two top priority areas to be addressed in worker health and safety. Another survey of self-reported musculoskeletal work-related injuries among truck drivers in the United Kingdom found that 81% reported musculoskeletal problems in the last year, mostly involving the low back as well as high numbers of shoulder, knee, and neck problems (Robb & Mansfield, 2007). Friswell and Williamson (2010) found that half of reported injuries in short-haul transportation drivers in

New South Wales were related to the back, and half were related to strains; strains and sprains are associated with high medical costs (Smith & Williams, 2014).

Truck driver falls due to entering and exiting the trailer cab and freight-moving injuries ranked among the top injuries for both short-haul and long-haul trucking. To prevent falls, several prevention policies are recommended. First, an employer safety policy that requires slip-resistant footwear should be considered. A study of 475 restaurant workers found that shoes less than six months old were more effective at preventing slips than older shoes, and changing to a new pair of slip-resistant shoes was associated with a 55% decrease in falls due to slipping (Verma et al., 2014). For truck cab steps, industrial strength slip-resistant padding can be applied to increase traction. While most trucks are manufactured with some type of handle bar for support while entering and exiting the cab, it is recommended that one be placed

just inside the driver's side door that extends from the floorboard to dash height. Having the handle on the interior prevents it from getting wet, and provides ready access to drivers as they enter and exit the cab. Also, trucking companies may emphasize the importance of maintaining three points of contact with the truck at all times when entering and exiting the cab (i.e. one foot and two hands, or two feet and one hand).

There were several limitations to the present study. First, the narrative text fields for 45 (16%) of short-haul trucking workers and 109 (24%) of long-haul trucking workers could not be properly coded since they were lacking sufficient descriptive information. Second, there was no industry employment denominator data for the short-haul and long-haul groups to determine incidence rates. Third, there were 89 missing values for short-haul trucking (31%) and 71 missing values for long-haul trucking (16%) regarding the length of time between hire and injury that could skew the length of time on the job results.

Conclusions

Analysis of FROI narrative data provides valuable identification of specific contributing factors, and outcomes associated with injuries that cannot be gleaned from analysis of standard workers' compensation data-set fields such as a strain as the 'cause of injury' or the back as the 'injured body part'. Also, from an injury control perspective, analysis of narrative text that identifies common activities resulting in injuries can be very informative for targeting intervention and training programmes. Findings from this study can be used to inform intrastate vs. interstate trucking injury prevention strategies such as an enhanced focus on driver safety training and safe freight handling in short-haul trucking, and tarping, trailer safety, and cab ingress and egress in long-haul trucking.

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