An Investigation into Type, Severity, and Cost of Injuries in the Automotive Repair Sector: Overall and by Age

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ECSTASY D. ADKINS

has been approved for

the Department of Industrial and Systems Engineering

and the Russ College of Engineering and Technology by

Diana J. Schwerha

Associate Professor of Industrial and Systems Engineering

Dennis Irwin

Dean, Russ College of Engineering and Technology

ABSTRACT

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An Investigation into Type, Severity, and Cost of Injuries in the Automotive Repair Sector: Overall and by Age

Director of Thesis: Diana J. Schwerha

According to data from the Ohio Bureau of Workers' Compensation (Ohio BWC, 2013), the automotive service or repair center industries rank among the top industries in the number of claims and total cost due to work-related injuries. However, little research has been conducted to determine the characteristics that lead to such injuries. The objective of this study was to analyze the types of injuries and illnesses that are occurring in the automotive repair sector to determine common characteristics and the significant factors that led to the injuries along with estimated costs using 2011 BWC data. Specific events or exposures that led to the injury or illness, the source of injury or illness, primary body parts affected, and nature of injury or illness were identified. Also, the relationship between age and claims cost as well as the rate of injury occurrence by age was studied. Furthermore, analysis indicated that contact with objects or equipment was the highest ranked category in terms of frequency. Overexertion and bodily reaction and falls, slips, and trips were the top groups by severity. Other results included eyes as the number one body part affected in the struck by object or equipment category and ice/snow as the greatest cause of injury for falls on the same level. Additionally, it was determined that the number of falls, slips, and trips in relationship to other injuries increased with age, in contrast to the contact with objects or equipment category which decreased by age.

DEDICATION

This thesis was written in dedication to my beautiful daughter, Madison.

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First, I would like to acknowledge the Ohio Bureau of Workers' Compensation for the use of the data and resources. I would especially like to thank Mike Lampl at the Ohio BWC for lending his expertise to this study. Next, I would like to thank my thesis committee members, Dr. Koonce, Dr. Ryan, and Dr. Weckman for taking the time out of their busy schedules to meet with me and review my documents. Last but certainly not least, I would like to thank my advisor, Dr. Schwerha, for her patience and assistance with the thesis process.

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CHAPTER 1: INTRODUCTION

Employees in the automotive repair sector are subject to physically demanding work, and some of their job duties require them to work in awkward postures. Employees may have to reach overhead, bend, lie down to work under vehicles, and manually handle heavy equipment for prolonged time periods. This type of work has a high risk of injury and can lead to workers' compensation claims. The consequences of a workers' compensation claim can be quite costly to both the employer and employee. Approximately 33,300 OSHA reportable injuries in the repair and maintenance industry were documented in 2011 (BLS, 2012b). This was an average of 3.1 injuries per 100 full-time workers (BLS, 2012b).

Furthermore, in 2011 the automobile service and repair industries ranked 7th in total claims count in comparison to other industries serviced by Ohio BWC (Ohio BWC, 2013). This industry ranked 3rd in total cost with over 18 million dollars spent and incurred an average claims cost of $6,781 (Ohio BWC, 2013). According to the Ohio Department of Job and Family Services (2013), the number of jobs held by automotive body and related repairers is projected to increase by 3.6%, and the number of automotive service technicians and mechanics is estimated to rise 5.7%. The growth in the industry along with the staggering numbers provided by the BWC indicates the need for an in-depth investigation into this manual classification.

Considerable research has been conducted analyzing general claims characteristics to determine critical factors and causes of on the job injuries. Very few studies, however, have been completed that focus on the automotive repair industry.

Research from the BLS (Bureau of Labor Statistics) of 2003 to 2005 OSHA reportable injuries on automotive service technicians involving days away from work focused on the cause, source, nature of injuries, and body parts affected (Smith, 2007). Another study was conducted in India which involved self-reporting that centered on worker characteristics, types of injury, stressors, body regions susceptible to pain, and work aspects that led to on the job injury in automobile repair workers (Vyas, Das, & Mehta, 2011).

The focus of this study was the analysis of 2,100 Ohio Bureau of Workers' Compensation (BWC) claims from 2011 in the manual classification that includes automobile service or repair centers & drivers. Past studies on automotive repair have focused on OSHA reportable claims or self-reporting. The BWC claims consist of workers' compensation claims reported by state-insured employers in the industry. This includes all medical and lost-time claims not just those reportable to OSHA as analyzed by the BLS. The use of the BWC data, not only allowed the ability to investigate injuries in an industry that has been under-analyzed, but 30 month injury cost data was also available. The drivers behind the workers' compensation injuries as well as the associated costs incurred were determined using the data provided by the BWC.

The goal of this study was to analyze claims information provided by the BWC on the automobile service and repair industries to determine common characteristics and significant factors that led to injuries and illnesses. This was accomplished by aggregating the data given by the BWC and a separate data collection process to identify information such as specific events or exposures, the source of injury and illness, the

parts of body affected, and the nature of injury or illness. The relationship between age and claims costs as well as the rate of injury occurrence by age group was also studied.

CHAPTER 2: LITERATURE REVIEW

2.1. Job duties and hazards in the automotive repair sector

Employees working in automotive shops are subject to physical and chemical hazards while working on the job. Potential physical hazards include exploding tires, slips, trips, and falls from poor housekeeping, moving vehicles, lifting equipment failure, falling from ladders and other surfaces, falling vehicles, and the manual handling of large parts and tires (Worksafe Victoria, 2004). Tasks such as working under vehicle hoods and beneath vehicles cause employees to work in awkward and prolonged postures. This work may put the wrists and arms in uncomfortable positions, require the worker to bend and reach for long periods of time, and necessitate the use of heavy tools (Worksafe Victoria, 2004). Types of equipment used consist of computerized diagnostic tools, various types of power tools including pneumatic jacks and hoists, and hand tools like wrenches, sockets and ratchets, and pliers (BLS, 2014). Some chemical hazards associated with the automotive repair sector include dusts, metal fumes, asbestos, solvents, fuels, and vehicle emissions (State of Delaware, 2014).

2.2. Previous automotive studies

There are very few documented studies on the automotive repair sector that relate to on the job injuries. One study conducted by the BLS (Smith, 2007) investigated the work-related injuries, illness, and fatalities involving automotive service technicians and mechanics that occurred in 2003-2005. The focus of the study was on OSHA recordable injuries involving days away from work and fatalities. Results indicated that mechanics ranked 14th in 2004 and 2005 among all industries in terms of days away from work as a

consequence of injury or illness in the workplace. The greatest causes of injury to mechanics in 2005 were contact with object or equipment (45%) and overexertion (22%). The main source of injury in 2005 was parts and materials (27%). Sprains and strains (33%) and cuts, lacerations, and punctures (16%) were the top nature of injuries and illnesses in 2005. Analysis from the study found upper extremities to be the top body parts affected in 2005. The event or exposure leading to missed worked days in the automotive technician/mechanic industry in 2005 was overexertion (22%), followed by falls on the same level (7%).

Additionally, a survey conducted in India (Vyas, Das, & Mehta, 2011) of 153 subjects representing 35 automobile repair businesses gathered self-reported information on occupational injuries. Sixty-three percent of respondents indicated they had an on the job injury. Cuts (60%) were the number one injury reported. Hands (81%) and fingers (18%) were the main body parts affected. Pain was experienced by 85% of those questioned. According to the results of the survey, the lower back and upper back were the most significant regions where pain was experienced.

2.3. Older workers

The workforce is aging due to an explosion in the population by the baby boomers. It is projected that from 2008 to 2018 the number of older workers comprising the workforce will increase from 18% to 24% (Rappaport, Wojcik, & Baxter, 2011). There are many reasons why workers are deciding to work longer. One explanation is that people are actually living longer (Rappaport et al., 2011); therefore, they have more working years. Also, most employers are no longer offering rich retirement plans and

retiree health insurance (Green, 2006). These types of plans enticed employees to retire early. Now, employees need to focus on their own contributions to their retirement plans. Another motivation is the recent poor economic conditions that have plagued most employee retirement portfolios (Rappaport et al., 2011). Employees may need to recover their losses or could be working until they become comfortable with their economic situation.

As a result of the increase in the number of older workers, it is important to gain an understanding of the impact they have on the workers' compensation system. Studies show that the incidence of a work related injury is less for older workers than younger workers (Farrow & Reynolds, 2012; Restrepo, Sobel, & Shuford, 2006; Smith et al., 2005). Despite having fewer claims, older workers have a higher rate of severity due to an on the job injury than their younger counterparts (Wolf, 2010). Research also indicates that older employees have more hospitalizations (Grandjean et al., 2006), suffer from more disabling conditions (Rogers & Wiatrwoski, 2005), and take longer to recuperate (Personick & Windau, 1993). In addition, older workers have a higher rate of fatalities (Grandjean et al., 2006; Rogers & Wiatrowski, 2005).

Moreover, older workers miss more time due to an occupational injury than younger workers (Farrow & Reynolds, 2012; McCoy, Kucera, Schoenfisch, Silverstein, & Lipscomb, 2013; Rogers & Wiatrowski, 2005). Analysis by the BLS (2012a) of nonfatal occupational injuries and illnesses involving days away from work in the private industry in 2011 demonstrates that the median days away from work escalates as the age of the employee increases. According to the BLS, employees in the 25-34 age range miss

a median of 6 days of work in comparison to the 14 days employees ages 65 and older are absent because of an on the job injury.

2.4. Claims costs

Research by NCCI (The National Council on Compensation Insurance) (Restrepo et al., 2006) on lost time claims costs reported at 18 months post injury for the years 1996-2003 illustrates that claims cost rises with age. NCCI explains that workers in the 55-64 age range have an average claims cost of $27,500 in comparison to those in the 20-24 age range at $12,200. An analysis of the average indemnity (compensation paid for lost time) paid per claim for 2000-2006 by NCCI (Wolf, 2010) demonstrates that the average indemnity cost per claim grows with age up into the 45-49 age range. It tapers off slightly for the 50-54 age group and then increases for those 55-64, falling for the 65 and over employees.

Likewise, similar analysis conducted by NCCI (Wolf, 2010) on the average medical cost per claim by age in 2000-2006, shows a cost growth in claims cost by age. Workers 65 and older incur compensation costs approximately 26% more than the average claims cost for all workers. A reason for older workers having a higher medical severity is the type of injuries they suffer compared to younger workers. Analysis by NCCI (Restrepo et al., 2006) of the top 10 lost-time claim diagnoses suffered by workers in the age groups 20-34 and 45-64 indicates that both classes are susceptible to carpal tunnel syndrome and injuries to the lumbar region. The biggest difference in the two age groups is that the younger age group tends to have injuries that involve sprains which cost much less than the rotator cuff and knee injuries suffered by those ages 45-64.

2.5. Characteristics of workers' compensation injuries

2.5.1. Statistics for injuries across all industries

According to NCCI research (Wolf, 2010) of workers' compensation injury claims for the years 2000-2006, strains is the highest cause category of injuries for all age groups. Strains accounted for 38% of claims followed by fall/slip/trip at 22%. More claims were reported for sprain/strains (45%) as the nature of injury than any other category. Arms/shoulders were the top body parts injured followed by lower back and hand/finger(s)/wrist(s).

Furthermore, analysis of lost-time work claims using BLS data from 2009 (Wuellner et al., 2011) indicated contact with objects and equipment to have the highest rate of injury at 28%. This was followed by overexertion at 26% and falls on the same level at 18%. Falls on the same level increased with age, but overexertion claims peaked at the 35-44 age range then decreased steadily with age. Injuries from falls at the same level were 27.5% for workers aged 55-64 years as compared to overexertion at 23.1%. The numbers were much greater for those 65 and older. Falls on the same level were 39.2% compared to overexertion at 13.9%.

In addition, a study using National Health Interview Survey data from 1997-1999 (Smith et al., 2005) examined self-reported work-related and non-work related injuries for adults ages 18-64. Analysis indicated that sprains and strains were the top category for nature of injury (34%). Open wounds were the next cause at 21% followed by fractures at 9%. Upper extremities (37%) were the most common body region injured in a work-related injury.

2.5.2. Industry specific statistics

Although there has been little research on workers' compensation claims from the automotive repair sector, there have been studies conducted on similar occupations. Industries comparable to those in the BWC manual classification used in this research include railway workers, industrial maintenance, construction, and truck drivers. For example, a study of railway workers found falls on the same level to be the leading cause of injury among railway workers (Chau et al., 2010). Results also indicated that older railway employees were at a higher risk of falling on the same level or to a lower level than younger employees.

Additionally, research of severe non-fatal accidents in the industrial maintenance industry established crushing or being trapped in between components to be the leading type of accident at 39%, followed by jumping or falling at 21% (Lind, 2008). Fractures and cuts and minor bruises were the main types of injuries suffered by industrial maintenance employees (Lind, 2008).

Moreover, a study of construction industry visits to the emergency department found the number of falls among construction workers to decrease with age and that falls were the third leading cause of injury (Shishlov, Schoenfisch, Myers, & Lipscomb, 2011). Analysis demonstrated that younger workers (under the age of 40) in the construction sector suffered from fewer fractures in comparison to sprain/strains and contusion/abrasions. However, for older workers (40 and older) the rates of injury in the sprain/strain and fracture categories were almost the same. The number of contusions/abrasions was significantly less for older workers.

Lastly, a case study of truck drivers (Rogers & Wiatrowski, 2005) using 2003 data from the Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses and the Census of Fatal Occupational Injuries indicated that even though sprains, strains, and tears is the biggest category for nature of injury among all ages, the percentage of sprains, strains, and tears decreases with age. However, the number of fractures increases with age. According to the study, falls was second to transportation as the leading cause of fatalities in workers 65 and older.

CHAPTER 3: RESEARCH QUESTIONS

The objective of this study was to determine common characteristics and significant factors that led to injuries and illnesses in the automotive repair sector. Specific events or exposures that led to the injury or illness, the source of injury or illness for specific categories, the primary body parts, and the natures of injury or illness were identified. Also, the role of age on claims costs as well as the rate of injury occurrence by age group was studied. The thesis was divided into three components: 1) the selection and preparation of the data set for analysis, 2) the development of descriptive statistics of the types of injuries in the auto repair sector, and 3) the investigation of several research questions that are related to the aging workforce.

Five research questions were examined:

Research Question 1: How does the rate of overexertions in relationship to other injuries compare by age?

Research Question 2: How does the rate of falls, slips, and trips in relationship to other injuries compare by age?

Research Question 3: How does the rate of contact with objects or equipment in relationship to other injuries compare by age?

Research Question 4: What is the relationship between age and cost for overexertions?

Research Question 5: What is the relationship between age and cost for falls, slips, and trips?

CHAPTER 4: METHODS

4.1. Population

The study population for this research was 2,100 workers' compensation claims from 2011 classified under the Ohio BWC manual classification number 8380. This classification number is defined as automobile service or repair centers & drivers. Employers are assigned specific manual classifications based on their industry type. Companies may have one or more classifications depending on the types of jobs performed at their establishment. When entering a new claim, it is the responsibility of the Ohio BWC claims service specialist to choose the manual classification.

The original data set included 2,420 workers' compensation claims. The focus of this study is on automotive technicians and repair employees; therefore, claims that were irrelevant to the study were eliminated. Those claims excluded were 9 administrative, 130 drivers, 42 sales, and 139 claims for which no job title was able to be determined.

4.2. Data provided

Claim numbers are automatically assigned by the BWC system to new claims. Ohio BWC customer service claims specialists enter specific information into the workers' compensation system for each claim. Temporary total days paid, total days lost, and cost are tracked by the BWC system. Claims information can be extracted from the Ohio BWC database. The data provided by the BWC for this research consisted of:

- Policy number
- Primary business name
- Primary DBA (doing business as) name

- Current primary manual number
- Classification manual number
- Claim number
- Current accident cause mechanism
- E-Codes
- Optimal return to work ICD codes
- Injured worker age in years
- Date of injury
- Gender
- Current claims type (medical only or lost time)
- Accident text (short description of injury)
- Temporary total days paid
- Total days lost in calendar days
- Medical cost (amount paid for medical expenses incurred by the injured worker)
- Indemnity cost (amount paid for lost wages and compensation for permanent damage to the injured worker)
- Total cost (including the reserve which is the projected total cost of the claim deducting what has already been paid)

Limited or incomplete information was supplied by the BWC in the categories for the current accident sub-cause mechanism, injured worker's hire date, and injured worker's occupation name. The data was insufficient because in most cases these fields are not required to be completed by the claims service specialist. Sub-cause mechanism

information was only provided for 490 claims. The types of claims for which sub-cause mechanism data was available are assaults, falls, fire and flames, firearm/air gun missiles, motor vehicle non-traffic, motor vehicle traffic, natural/environmental events, and poisonings by other.

4.3. Data collection

4.3.1 Claims documents

Claims documents are stored in the Ohio BWC system. Typical documents include the FROI (First Report of Injury) shown in Appendix A, documents provided by the employer, medical documents, and other BWC documents such as legal and hearing notices. This information is confidential. Access to these documents was granted by the BWC for data collection purposes.

4.3.2. Occupation name

The occupation name field was completed by the claims service specialists for 2,224 of the 2,420 original workers' compensation claims. However, there were several claims that did not contain an actual job title. Fields such as blank, unknown, N/A, employee, and laborer required additional research. Each job title in the occupation name category needed to be examined to decide if more information was needed to identify the employee's actual job classification. There were 630 different groups of job titles in the data set. The job titles were analyzed and organized into a smaller list of occupations in order to gain an understanding of what types of jobs existed in the automobile service or repair centers & drivers manual classification. Job titles that were not entered by the

claims specialist or that needed further clarification were found by searching the FROI, employer documents, and medical documents in the BWC system.

Furthermore, once the job titles were sorted, the types of occupations included within the manual classification were examined to determine if they were relevant to the study. Those claims that do not fit the research of the automotive repair sector were eliminated. It is important to note that claims are classified in this manual classification by the BWC claims service specialists. In addition, drivers/porters are included within this manual classification, but do not meet the scope of this project. As mentioned in the population section those claims excluded were 9 administrative, 130 drivers, 42 sales, and 139 claims for which no job title was able to be determined.

4.3.3. Event or exposure

The current BWC system classifies claims by cause and in some cases sub-cause mechanisms. For this study, the BLS Occupational Injury and Illness Classification System (OIICS), Version 2.01 was used to describe the event or exposure that led to each claim. The accident descriptions and/or BWC claims documents were used to choose the proper classifications. The following divisions were used to classify the claims:

- Violence and other injuries by persons or animals
- Transportation incidents
- Fires and explosions
- Falls, slips, trips
- Exposure to harmful substances or environments
- Contact with objects or equipment

- Overexertion and bodily reaction
- Non-classifiable

The claims were then classified into BLS subcategories for event or exposure such as struck by object or equipment, overexertion involving outside sources, falls on same level, and falls to lower level. The count of claims was determined for each division and subcategory as well as the costs associated with the event or exposure.

4.3.4. Source of the injury or illness

Claims were further analyzed to determine the source of the injury or illness. The source was found by using the accident description or using claims documents. This analysis was completed using the BLS OIICS System, Version 2.01. The following divisions were used to classify claims:

- Chemicals and chemical products
- Containers, furniture, and fixtures
- Machinery
- Parts and materials
- Persons, plants, animals & minerals
- Structures and surfaces
- Tools, instruments, and equipment
- Vehicles
- Other sources
- Non-classifiable

The source of injury or illness was further divided into BLS subcategories. Examples of the subcategories were vehicle and mobile equipment parts, hand tools-non-powered, and bodily motion or position of the injured or ill worker. The count of claims and related costs were determined for the groups within each division and subcategory.

4.3.5. Part of body affected

The BWC system does not have a field where the claims representatives enter the primary body part injured. As a part of this project, the main body part injured was decided for each claim. The first step in determining the primary body part affected was to assign descriptions to the optimal return to work ICD codes. ICD codes are used by medical professionals for medical coding. Claims are assigned an optimal return to work ICD code by the claims service specialists. Workers' compensation claims may have multiple ICD codes. It is at the discretion of the claims representatives to decide which code is the optimal return to work ICD Code.

Moreover, The BWC database has a list of descriptions for each ICD Code. For this study, ICD code descriptions were assigned to each optimal return to work ICD code. The body part was named in some ICD code descriptions. In situations where the part of the body could not be identified by the ICD code description, a more in depth analysis of the claim was conducted. Information regarding body parts was listed on the FROI for some of the claims, but in most cases the medical notes were used to make an assessment. Classification was done using the part of body affected job titles included in the BLS

OIICS system, Version 2.01. The body parts were first classified into the following divisions:

- Head
- Neck (including throat)
- Trunk
- Upper extremities
- Lower extremities
- Body systems
- Multiple body parts
- Other body parts
- Non-classifiable

Next, the claims were separated into subcategories as listed in the BLS classification system. As a final step, the face and leg subcategories were divided into smaller categories so that specific body parts such as eyes and knees could be identified. The count of claims and the related costs were determined for the different categories.

4.3.6. Nature of injury

The nature of injury was assigned by using the optimal return to work ICD Codes and associated ICD Code descriptions. The method for determining the ICD codes was explained in the previous section. ICD codes were analyzed by claims count and total, average, medical, and indemnity cost.

4.4. Analysis method

The desired output of this project was useful data to determine the significant factors that led to an injury, the types of injuries, the body parts affected, and the related costs. This was done by using descriptive statistics to summarize the data and through the investigation of five research questions. The five research questions as well as the method for examining each are as follows:

Research Question 1: How does the rate of overexertions in relationship to other injuries compare by age?

In order to research this question, the total number of claims and the number of overexertion and bodily reaction claims were determined and divided into age groups. The age intervals for this research were the same as used by the BLS. The age intervals were 16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+. Next the number of overexertion and bodily reaction claims was divided by the total number of claims to find the rate of overexertion claims for each age group. These rates were then compared by age group to see the similarities and differences between the age groups.

Research Question 2: How does the rate of falls, slips, and trips in relationship to other injuries compare by age?

In order to research this question, the total number of claims and the number of falls, slips, and trip claims were determined and divided into age groups. The age intervals for this research were the same as used by the BLS. The age intervals were 16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+. Next the number of falls, slips, and trips claims was divided by the total number of claims to find the rate of falls, slips, and trips

claims for each age group. These rates were then compared by age group to see the similarities and differences between the age groups.

Research Question 3: How does the rate of contact with objects or equipment in relationship to other injuries compare by age?

In order to research this question, the total number of claims and the number of contact with objects or equipment claims were determined and divided into age groups. The age intervals for this research were the same as used by the BLS. The age intervals were 16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+. Next the number of contact with objects or equipment claims was divided by the total number of claims to find the rate of contact with objects or equipment claims for each age group. These rates were then compared by age group to see the similarities and differences between the age groups.

Research Question 4: What is the relationship between age and cost for overexertions?

The first step in researching this question was to separate the number of overexertion and bodily reaction claims by total cost into cost and age groups. The number of claims for each cost and age group was then divided by the total number of claims in each age group to determine the percentage of overexertion and bodily reaction claims by cost and age groups. The age groups were the same as used by the BLS. The age groups were as follows: 16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+. Also, the cost groups were the same as used by NCCI. Those groups were <2K, 2K-10K, 10K-50K, 50K-250K, and 250K+. After the percentage of overexertion and bodily reaction claims was calculated, the individual cost groups were then analyzed by age groups to determine the relationship between age and cost for overexertions.

Research Question 5: What is the relationship between age and cost for falls, slips, and trips?

The first step in researching this question was to separate the number of falls, slips, and trips claims by total cost into cost and age groups. The number of claims for each cost and age group was then divided by the total number of claims in each age group to determine the percentage of falls, slips, and trips claims by cost and age groups. The age groups were the same as used by the BLS. The age groups were as follows: 16-19, 20-24, 25-34, 35-44, 45-54, 55-64, and 65+. Also, the cost groups were the same as used by NCCI. Those groups were <2K, 2K-10K, 10K-50K, 50K-250K, and 250K+. After the percentage of falls, slips, and trips claims was calculated, the individual cost groups were then analyzed by age groups to determine the relationship between age and cost for falls, slips, and trips.

CHAPTER 5: RESULTS

5.1. Demographics

The study population for this research was 2,100 workers' compensation claims. There were 2,014 cases (95.9%) involving male subjects and 86 cases (4.1%) involving female subjects (Table 1). The mean age of the subjects was 38.1 years with a standard deviation of 12.9 years. The number of subjects by age group is listed in Table 1. The majority of the subjects fell into the 25-34 (25.2%), 35-44 (21.5%), and the 45-64 (22.2%) age groups. Other age groups by percentage of claims were 20-24 (14.9%), 55-64 (10.7%), 16-19 (4.2%), and 65+ (1.3%).

Table 1

Gender and Age of Subjects

	Gender		
Age group	**Male**	**Female**	**Total**
16-19	84	4	88
20-24	295	17	312
25-34	512	18	530
35-44	436	16	452
45-54	448	18	466
55-64	214	11	225
65+	25	2	27
Total	2,014	86	2,100

In addition, there were many job classifications represented in this study. Table 2 lists the job classifications by claims count. There were several job classifications which only had a few claims. Those job groups were combined into the category other job classification. This group accounted for 10.3% of the claims. The top job classification

was technician/mechanic (32.4%) followed by auto technician/mechanic (10.7%), and service technician (4.8%).

Table 2

Job Classification of Subjects

Job classification	Count	Percent of total
Technician/mechanic	681	32.4%
Auto technician/mechanic	224	10.7%
Other job classification	216	10.3%
Service technician	100	4.8%
Other technician/mechanic	92	4.4%
Supervisor/manager, not elsewhere classified	83	4.0%
Tire technician	83	4.0%
Detail	79	3.8%
Laborer	70	3.3%
Service	65	3.1%
Body shop/collision	53	2.5%
Parts	43	2.0%
Diesel technician/mechanic	36	1.7%
Other tire employee	30	1.4%
General/employee/staff	29	1.4%
Car/truck wash/wash bay	28	1.3%
Lot	27	1.3%
Service manager	24	1.1%
Porter	21	1.0%
Glass technician/installer	20	1.0%
Auto body tech/repair	19	0.9%
Painter	18	0.9%
Truck technician/mechanic	16	0.8%
Owner/officer	14	0.7%
Reconditioner	13	0.6%
Repair	9	0.4%
Fabricator	7	0.3%

5.2. Event or exposure

The initial step in analyzing the collected data was to separate the 2,100 BWC claims by event or exposure. As indicated in Figure 1, contact with objects or equipment led this category by a large margin with 52.4% of the claims followed by overexertion and bodily reaction (21.2%) and falls, slips, and trips (14.5%). Other events or exposure by percentage of claims were exposure to harmful substances or environments (4.9%), transportation incidents (4.0%), fires and explosions (1.8%), and violence and other injuries by persons or animals (1.0%).

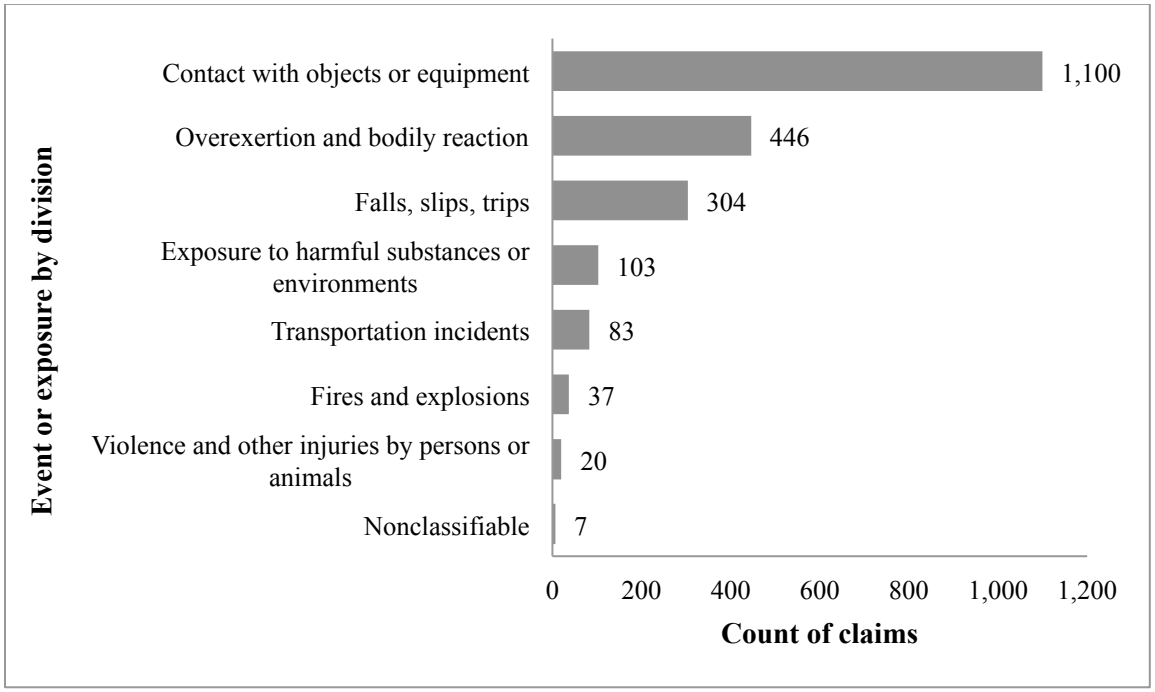

Figure 1. Claims by event or exposure (division).

Another of area of importance for this category was event or exposure by total cost. There was nearly the same amount of cost for the overexertion and bodily reaction

($4.5 million) and falls, slips and trips ($4.4 million) categories. Contact with objects was the next group by cost with $2.3 million. See Table 3 for event or exposures by division and the related costs.

Table 3

Event or Exposure (Division) by Total Cost

Event or exposure	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Overexertion and bodily reaction	1,882,802	1,059,827	1,513,150	4,455,779
Falls, slips, trips	1,722,402	906,216	1,811,828	4,440,446
Contact with objects or equipment	1,592,087	400,782	388,882	2,381,751
Transportation incidents	584,309	258,392	634,744	1,477,445
Fires and explosions	1,193,429	39,095	242	1,232,766
Violence and other injuries by persons or animals	17,289	74,945	587,325	679,558
Exposure to harmful substances or environments	100,991	27,460	16,253	144,704
Non-classifiable	3,094	0	0	3,094
Total	$7,096,402	$2,766,717	$4,952,425	$14,815,543

Furthermore, the events or exposures were divided into BLS subcategories. Although there are many subcategories in the BLS classification system, seven categories accounted for the majority of the data (Figure 2). The top three categories were struck by object or equipment (34.0%), overexertion involving outside sources (15.9%), and struck against object or equipment (13.5%). Other notable groups were falls on same level (7.3%), caught in or compressed by equipment or object (4.9%), falls to lower level (4.7%), and other exertions and bodily reactions (4.2%). The rest of the categories, with

exception of 1.2% non-classifiable claims, were combined into the other events or exposures subcategory which represented 14.4% of the claims. Also, the leading subcategories by total claims cost were overexertion involving outside sources ($3.9 million), falls to lower level ($2.0 million), falls on same level ($1.7 million), and struck by object or equipment ($1.4 million). The complete list of total cost by event or exposure subcategory is located in Appendix B.

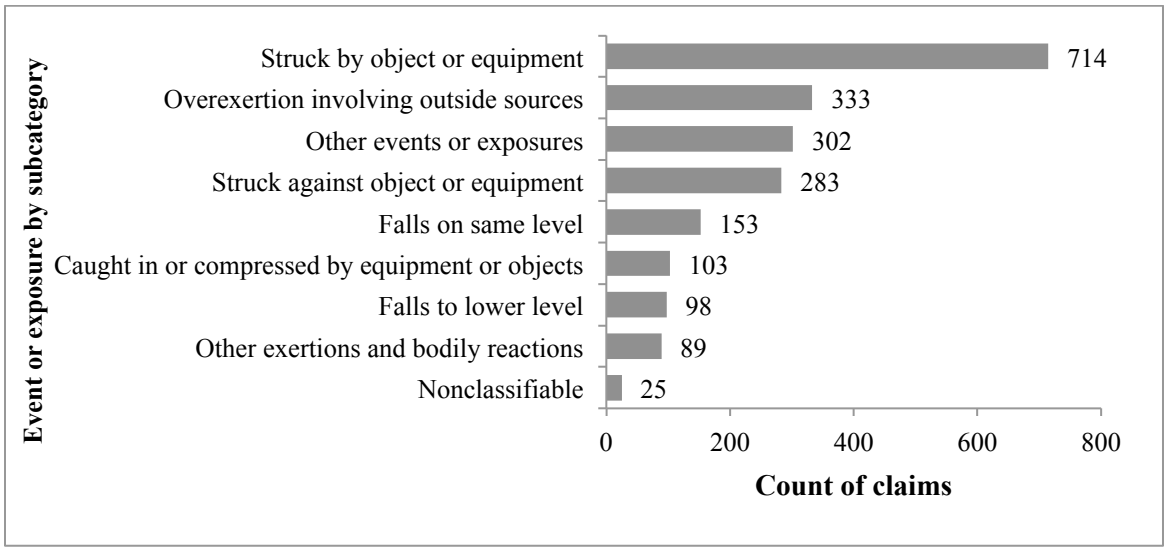

Figure 2. Claims by event or exposure (subcategory)

In continuance, medical only, lost time claims, and calendar days missed were analyzed by event or exposure. The most medical only claims were in the contact with objects or equipment classification (57.9%), with overexertion and bodily reaction (18.2%) and falls, slips, and trips (12.1%) ranking second and third respectively (Figure 3). On the other hand, the number one event or exposure for lost time claims (Figure 4) was overexertion and bodily reaction (37.1%) followed by falls, slips, and trips (26.9%),

and contact with objects or equipment (23.1%). Also, more calendar days were missed due to overexertion and bodily reaction (40.2%) than any other category (Figure 5). Other areas with a high number of days missed were falls, slips and trips (28.8%), and contact with object or equipment (16.0%).

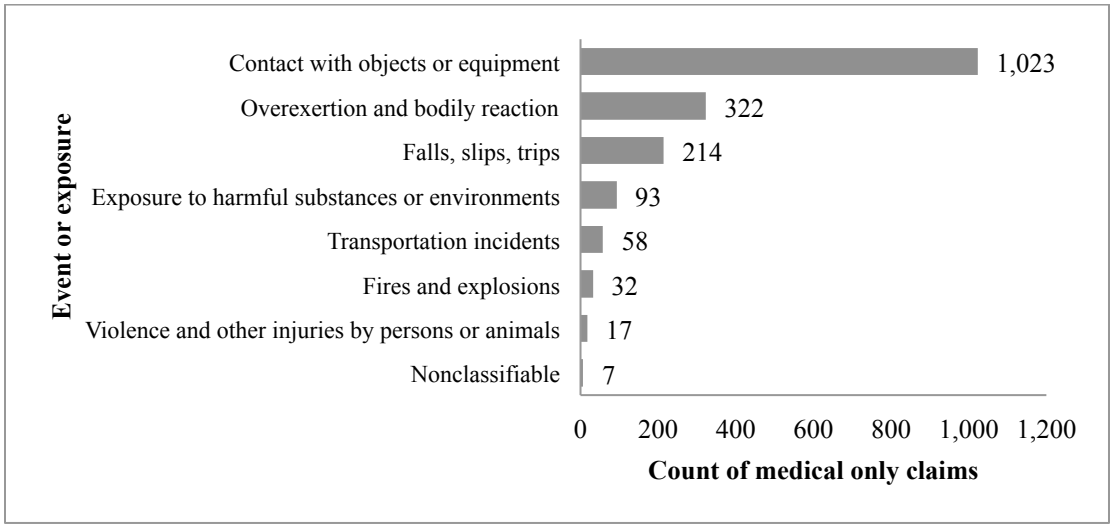

Figure 3. Medical only claims by event or exposure.

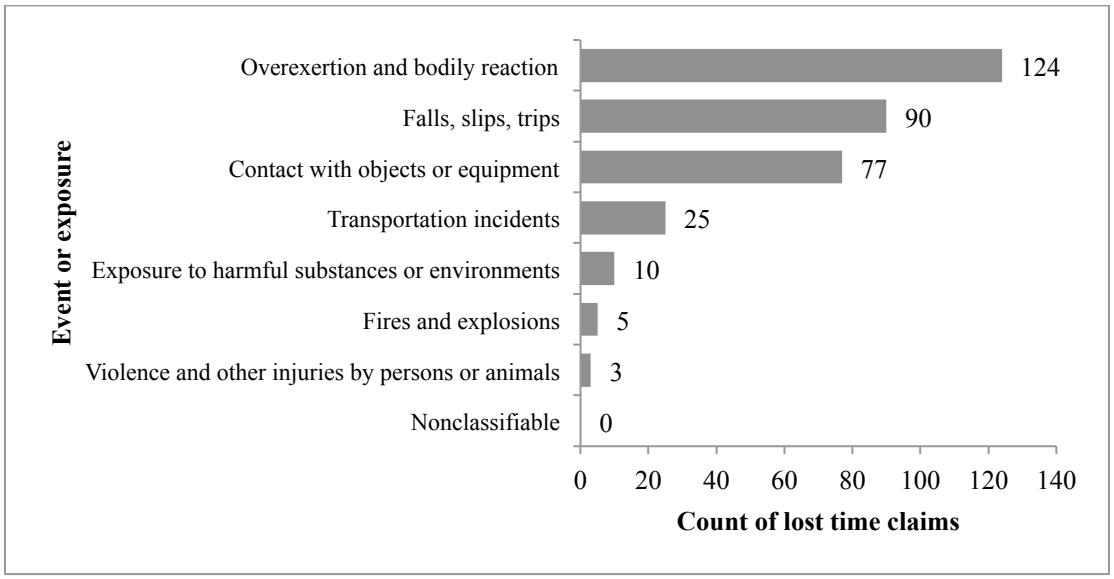

Figure 4. Lost time claims by event or exposure

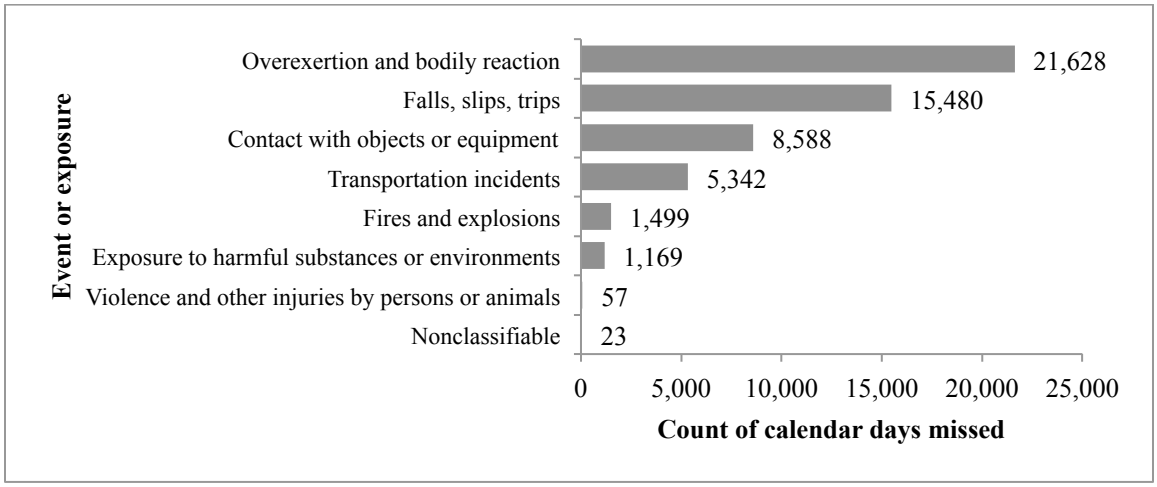

Figure 5. Calendar days missed by event or exposure.

Lastly, the events or exposures were divided by age groups (Table 4). The majority of all claims were in the 25-34 age group. This age group also had the most claims in the individual event or exposure categories with the exception of the 35-54 age group which led the overexertion and bodily reaction category and the 45-54 age group which had the most falls, slips, and trips claims.

Table 4

Event or Exposure- Number of Claims by Age Group

	Age group							
Event or exposure	16-19	20-24	25-34	35-44	45-54	55-64	65+	Total
Contact with objects or equipment	56	184	297	240	215	100	8	1,100
Overexertion and bodily reaction	8	55	108	114	109	49	3	446
Falls, slips, trips	9	32	62	54	90	46	11	304
Exposure to harmful substances or environments	7	17	29	20	19	11	0	103
Transportation incidents	3	16	19	14	17	9	5	83
Fires and explosions	3	4	11	3	10	6	0	37
Violence and other injuries by persons or animals	2	4	4	2	4	4	0	20
Non-classifiable	0	0	0	5	2	0	0	7
Total	88	312	530	452	466	225	27	2,100

5.3. Source of Injury or Illness

The sources of injury or illness were first classified by BLS divisions. The most notable sources of injury or illness by division (Figure 6) were parts and materials (20.6%), vehicles (19.5%), tools, instruments, and equipment (15.7%), and structures and surfaces (10.1%). The highest ranking sources of injury or illness by total cost (Table 5) were vehicles ($3.7 million), parts and materials ($3.2 million), structures and surfaces ($2.0 million), and machinery ($2.0 million).

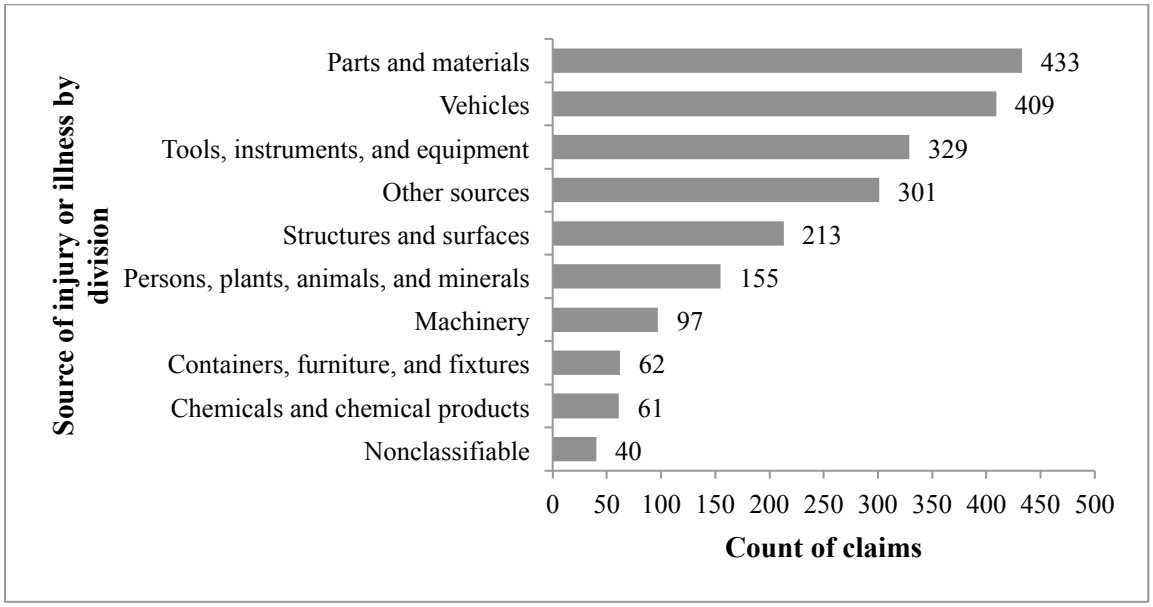

Figure 6. Claims by source of injury or illness (division).

Table 5

Source of Injury or Illness (Division) by Total Cost

Source of injury (by division)	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Vehicles	1,566,463	600,140	1,492,159	3,658,762
Parts and materials	1,437,971	718,056	1,016,934	3,172,961
Structures and surfaces	993,946	426,501	584,378	2,004,825
Machinery	1,425,836	159,052	405,481	1,990,369
Persons, plants, animals, and minerals	430,084	359,126	978,823	1,768,033
Tools, instruments, and equipment	778,517	380,267	418,111	1,576,895
Other sources	201,910	40,716	11,371	253,998
Containers, furniture, and fixtures	150,655	37,807	3,916	192,379
Non-classifiable	62,739	24,314	31,973	119,026
Chemicals and chemical products	48,281	20,737	9,278	78,296
Total	$7,096,402	$2,766,717	$4,952,425	$14,815,543

Additionally, the sources of injury or illness were divided into BLS subcategories. There are several subcategories for this group and many of them had a small amount of claims per category. The categories with a low percentage of claims were combined into one group, other sources of injury or illness. This grouping represented 20.9% of the sources of injury or illness (Figure 7). The subcategories with the greatest number of claims were motorized highway vehicles (18.3%), vehicle and mobile equipment parts (17.3%), scrap, waste, debris (12.9%), and non-powered hand tools (9.7%). See Appendix C for total cost figures of source of injury or illness by subcategory.

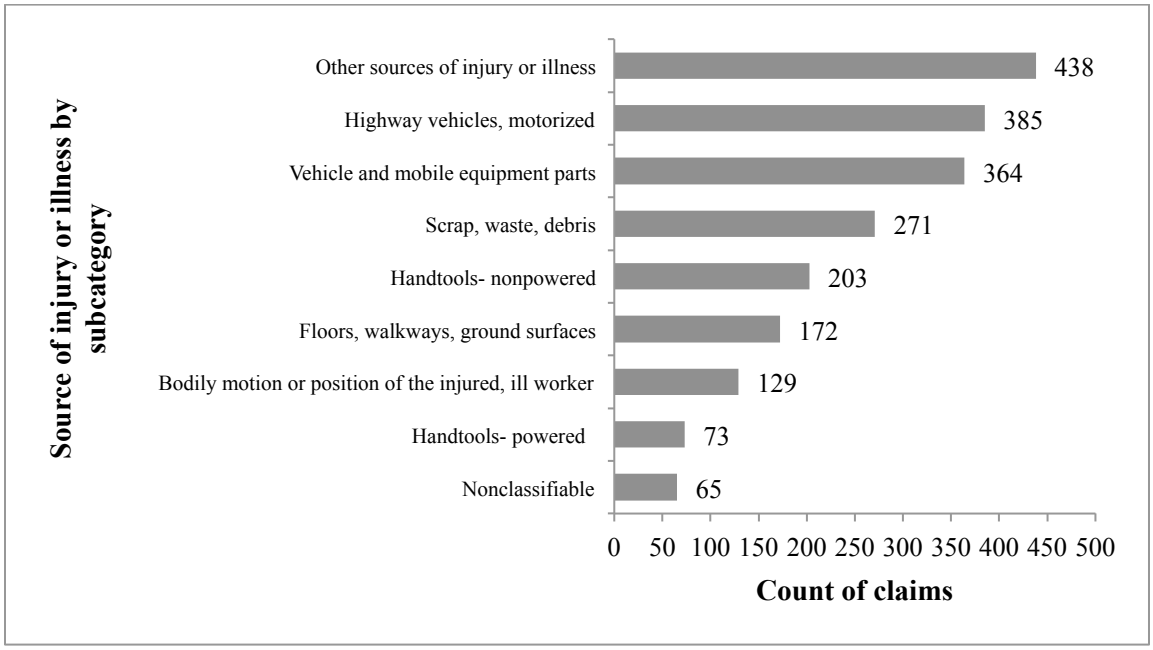

Figure 7. Claims by source of injury or illness (subcategory).

5.4. Part of body affected

The first step in the analysis of the part of body affected was to divide the body parts into the different BLS divisions. The division with the largest number of claims was upper extremities which encompassed 41.8% of the claims (Figure 8). Upper extremities were followed by the head (24.2%), the trunk (17.9%), lower extremities (13.0%), and other body parts (3.0%) which were a mixture of divisions with a low claims count. The most significant body regions by cost were upper extremities at $6.1 million, the trunk at $4.9 million, and lower extremities at $2.5 million (Table 6).

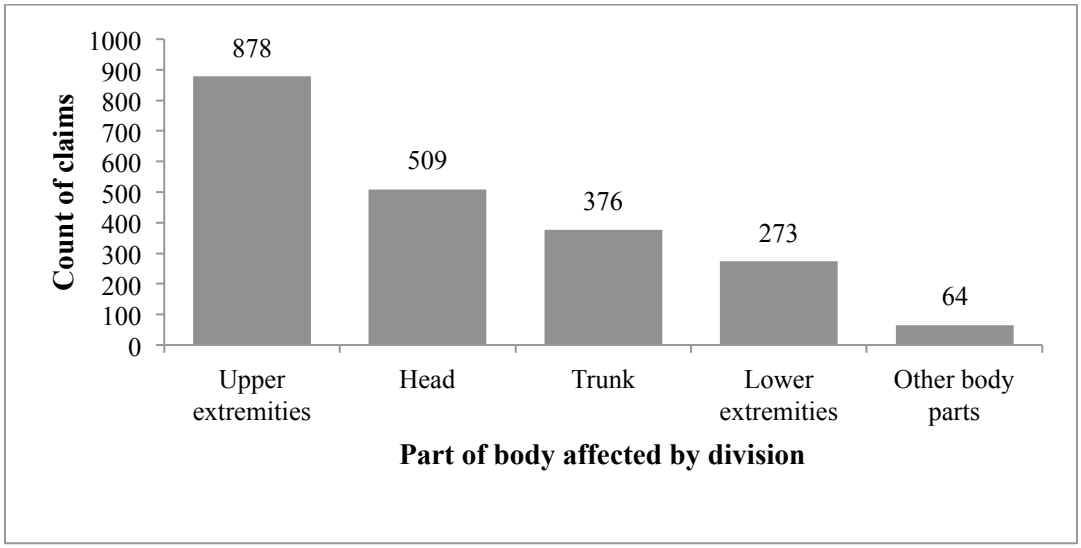

Figure 8. Claims by part of body affected (division).

Table 6

Part of Body Affected (Division) by Total Cost

Part of body affected (by division)	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Upper extremities	3,766,724	1,135,205	1,247,095	6,149,024
Trunk	1,590,348	1,003,210	2,305,479	4,899,036
Lower extremities	1,167,670	487,240	846,752	2,501,662
Head	488,354	114,220	551,311	1,153,885
Neck	57,856	8,855	1,110	67,821
Body systems	13,532	10,000	678	24,210
Multiple body parts	10,879	2,987	0	13,866
Non-classifiable	1,039	5,000	0	6,039
Total	$7,096,402	$2,766,717	$4,952,425	$14,815,543

Next the parts of the body affected were further divided by BLS subcategories to determine the claims counts by more specific body parts. Significant parts of body affected (Figure 9) were hands (25.5%), eyes (14.1%), backs (12.0%), arms (6.1%), and

shoulders (6.1%). See Appendix D for a detailed breakdown of total cost by part of body affected.

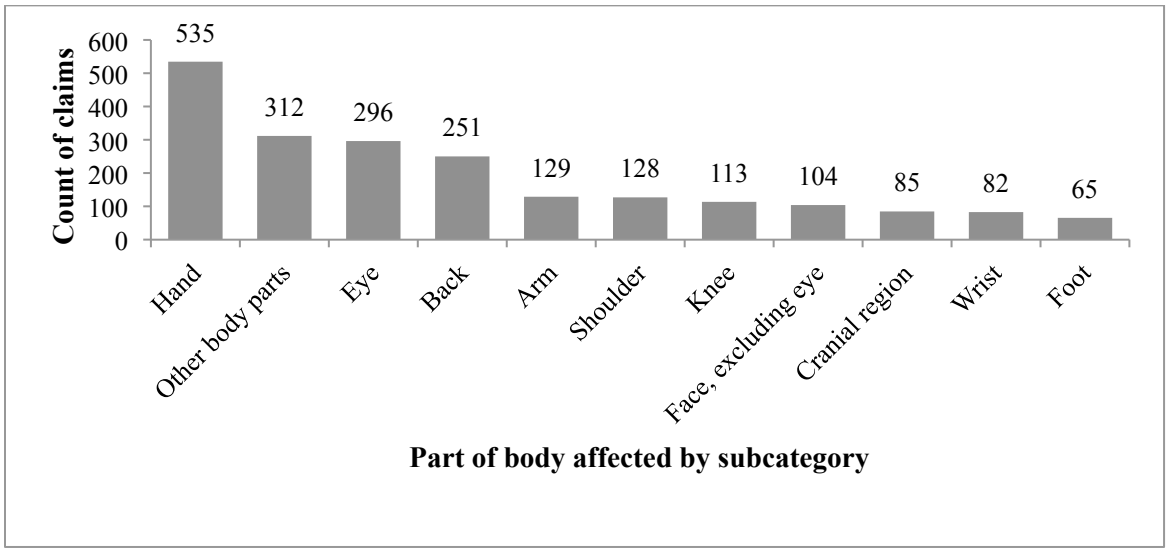

Figure 9. Claims by part of body affected (subcategory).

5.5. Nature of Injury

There were a wide variety of injuries in the automotive repair sector. Major injuries by count included wounds, sprains, corneal abrasions, foreign bodies to the eye, contusions, and disc displacements (Table 7). The most significant injuries by claims count were open wounds to the finger (170), sprains to the lumbar region (132), open wounds of the hand (103), and corneal abrasions (95). The top injuries by total cost (Table 8) were thoracic/lumbar displacements ($2.0 million), rotator cuff sprains ($1.9 million), third degree burn of two or more digits of the hand including thumb ($1.1 million), and an open wound of the trunk not elsewhere classified ($670,000).

Table 7

Leading Injuries by Claims Count

ICD code	ICD description	Claims count
883	OPEN WOUND OF FINGER	170
847.2	SPRAIN LUMBAR REGION	132
882	OPEN WOUND OF HAND	103
918.1	CORNEAL ABRASION	95
930	FOREIGN BODY EXTERN EYE	89
840.9	SPRAIN SHOULDER/ARM NOS	57
844.9	SPRAIN OF KNEE & LEG NOS	51
920	CONTUSION FACE/SCALP/NCK	51
846	SPRAIN SACROILIAC REGION	48
923.2	CONTUSION OF WRIST/HAND	48
873	OTHER OPEN WOUND OF HEAD	37
847	SPRAIN OF BACK NEC/NOS	36
840.4	SPRAIN ROTATOR CUFF	32
845	SPRAIN OF ANKLE & FOOT	32
842	SPRAIN WRIST & HAND	29
722.1	THORAC/LUMB DISC DISPLAC	26

Table 8

Leading Injuries by Total Cost

ICD code	ICD description	Claims count		Total cost
722.1	THORAC/LUMB DISC DISPLAC	26	$	2,022,719.23
840.4	SPRAIN ROTATOR CUFF	32	$	1,904,277.44
944.34	3 DEG BURN FINGR W THUMB	1	$	1,111,822.99
879.6	OPEN WOUND OF TRUNK NEC	1	$	665,025.28
844.2	SPRAIN CRUCIATE LIG KNEE	12	$	488,026.45
801.26	CL SKUL BASE FX-COMA NOS	1	$	425,300.10
836	DISLOCATION OF KNEE	11	$	408,353.78
805.4	FX LUMBAR VERTEBRA-CLOSE	2	$	381,785.14
722	INTERVERTEBRAL DISC DIS	5	$	331,499.43
821.01	FX FEMUR SHAFT-CLOSED	1	$	313,593.87
823.02	FX UP TIBIA W FIBULA-CL	1	$	309,188.12
726.1	ROTATOR CUFF SYNDR ET AL	10	$	290,189.40
847.2	SPRAIN LUMBAR REGION	132	$	279,687.54

As indicated in Table 9, most of the leading injuries by average claim cost were individual claims with a high claim cost. The most notable claim was the previously mentioned third degree burn. This was also the most expensive injury by total medical cost (Table 10). Other costly claims by total medical cost were 32 sprains to the rotator cuff ($710,000), 26 thoracic/lumbar disc displacements ($580,000), and 132 sprains to the lumbar region ($210,000). Lastly, leading injuries by total indemnity cost (Table 11) were 26 thoracic/lumbar disc displacements ($430,000), 32 rotator cuff sprains ($430,000), and dislocations to the knee ($160,000).

Table 9

Leading Injuries by Average Claim Cost

ICD code	ICD description	Claims count	Average claim cost
944.34	3 DEG BURN FINGR W THUMB	1	$ 1,111,822.99
879.6	OPEN WOUND OF TRUNK NEC	1	$ 665,025.28
801.26	CL SKUL BASE FX-COMA NOS	1	$ 425,300.10
821.01	FX FEMUR SHAFT-CLOSED	1	$ 313,593.87
823.02	FX UP TIBIA W FIBULA-CL	1	$ 309,188.12
801.09	CL SKULL BASE FX-CONCUSS	1	$ 221,161.18
805.4	FX LUMBAR VERTEBRA-CLOSE	2	$ 190,892.57
805.6	FX SACRUM/COCCYX-CLOSED	1	$ 164,297.00
824.7	FX TRIMALLEOLAR-OPEN	1	$ 154,162.37
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 134,182.79
823.2	FX SHAFT TIB/FIB-CLOSED	1	$ 129,468.21
337.21	RSD, UPPER LIMB	2	$ 111,216.02
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 104,284.41
805.2	FX DORSAL VERTEBRA-CLOSE	2	$ 78,743.64
722.1	THORAC/LUMB DISC DISPLAC	26	$ 77,796.89

Table 10

Leading Injuries by Medical Cost

ICD code	ICD description	Count	Medical cost
944.34	3 DEG BURN FINGR W THUMB	1	$ 1,093,739.57
840.4	SPRAIN ROTATOR CUFF	32	$ 709,646.58
722.1	THORAC/LUMB DISC DISPLAC	26	$ 575,589.58
847.2	SPRAIN LUMBAR REGION	132	$ 208,890.24
844.2	SPRAIN CRUCIATE LIG KNEE	12	$ 204,728.31
337.21	RSD, UPPER LIMB	2	$ 175,263.48
836	DISLOCATION OF KNEE	11	$ 152,574.10
821.01	FX FEMUR SHAFT-CLOSED	1	$ 146,757.89
840.9	SPRAIN SHOULDER/ARM NOS	57	$ 138,871.32
823.02	FX UP TIBIA W FIBULA-CL	1	$ 134,390.79
726.1	ROTATOR CUFF SYNDR ET AL	10	$ 128,509.46
842	SPRAIN WRIST & HAND	29	$ 105,343.96
883	OPEN WOUND OF FINGER	170	$ 104,179.63
550.9	INGUINAL HERNIA NOS	19	$ 98,135.11
722	INTERVERTEBRAL DISC DIS	5	$ 85,119.04

Table 11

Leading Injuries by Indemnity Cost

ICD code	ICD description	Count	Indemnity cost
722.1	THORAC/LUMB DISC DISPLAC	26	$ 433,197.08
840.4	SPRAIN ROTATOR CUFF	32	$ 430,750.85
836	DISLOCATION OF KNEE	11	$ 157,028.70
805.4	FX LUMBAR VERTEBRA-CLOSE	2	$ 100,393.87
844.2	SPRAIN CRUCIATE LIG KNEE	12	$ 78,413.13
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 75,850.02
879.6	OPEN WOUND OF TRUNK NEC	1	$ 74,944.74
722	INTERVERTEBRAL DISC DIS	5	$ 65,191.87
805.2	FX DORSAL VERTEBRA-CLOSE	2	$ 60,588.27
847.2	SPRAIN LUMBAR REGION	132	$ 60,224.12
801.09	CL SKULL BASE FX-CONCUSS	1	$ 52,474.10
844.9	SPRAIN OF KNEE & LEG NOS	51	$ 44,649.61
722.52	LUMB/LUMBOSAC DISC DEGEN	3	$ 44,401.15

5.6. Contact with objects or equipment

Contact with objects or equipment ranked highest in total claims count accounting for 52.4% of all claims by event or exposure. However, this category only ranked third in total cost with 2.4 million in total claims dollars which represented 16.1% of all cost by event or exposure. There were 1,100 claims involving contact with objects or equipment. As indicated in Figure 10, the vast majority of claims were classified as struck by object or equipment (64.9%). Other categories were struck against object or equipment (25.7%) and caught in or compressed by equipment or objects (9.4%). Struck by object or equipment represented 60.8% of total cost in the contact with objects or equipment category (Table 12). The total cost for struck by object or equipment was a little over $1.4 million. Caught in or compressed by equipment or objects was the next category by total cost with approximately $490,000 in total claims cost, and struck against object or equipment was last with approximately $440,000 in total claims cost.

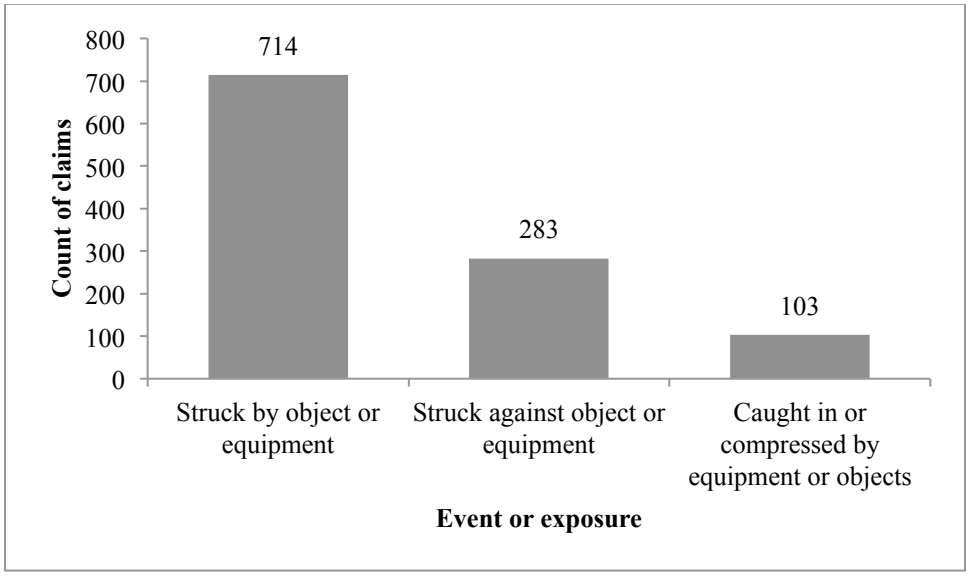

Figure 10. Contact with objects or equipment- claims by event or exposure

Table 12

Contact with objects or equipment- Event or Exposure by Total Cost

Event or exposure	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Struck by object or equipment	961,331	226,405	261,015	1,448,751
Caught in or compressed by equipment or objects	260,804	101,039	127,867	489,710
Struck against object or equipment	369,952	73,338	0	443,290
Total	$1,592,087	$400,782	$388,882	$2,381,751

Additionally, the greatest sources of injury for contact with objects or equipment (Figure 11) were vehicles (24.1%), tools, instruments, and equipment (22.3%), parts and materials (16.6%), and machinery (6.0%). Cost by source of injury or illness is listed in Appendix E. The most significant body part affected (Figure 12) was the hand at 42.7%. Other common body parts injured were eyes (22.0%), the face excluding the eye (8.1%), arms (5.8%), and cranial regions (5.5%). Costs by parts of body affected can be found in Appendix F. Typical natures of injury included wounds, abrasions, contusions, foreign bodies in the eye, and crushing injuries (Table 13). The leading injuries were open wounds of the finger (165), open wounds of the hand (99), corneal abrasions (85), and foreign bodies to the external eye (82). See Appendices G-J for cost data related to the nature of injury.

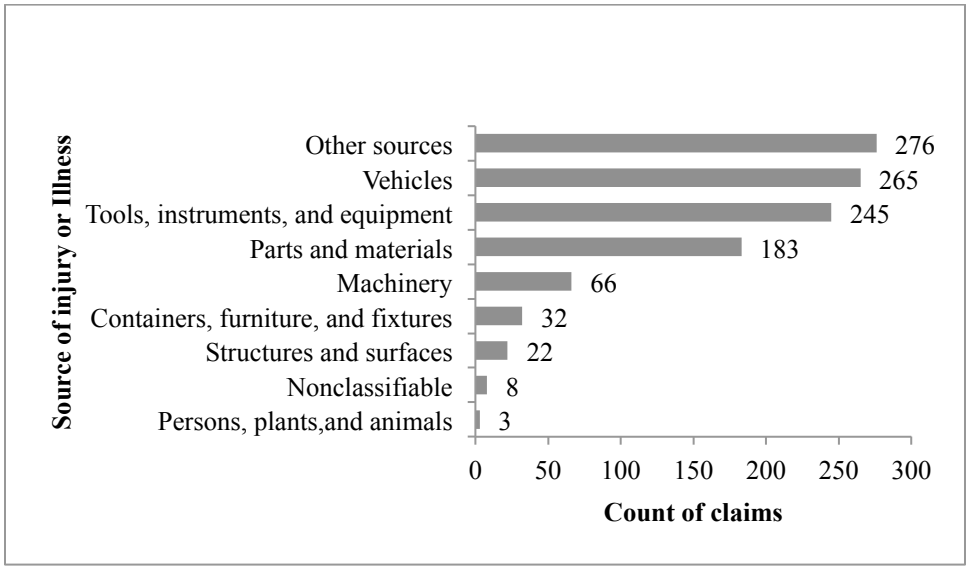

Figure 11. Contact with objects or equipment- claims by source of injury or illness.

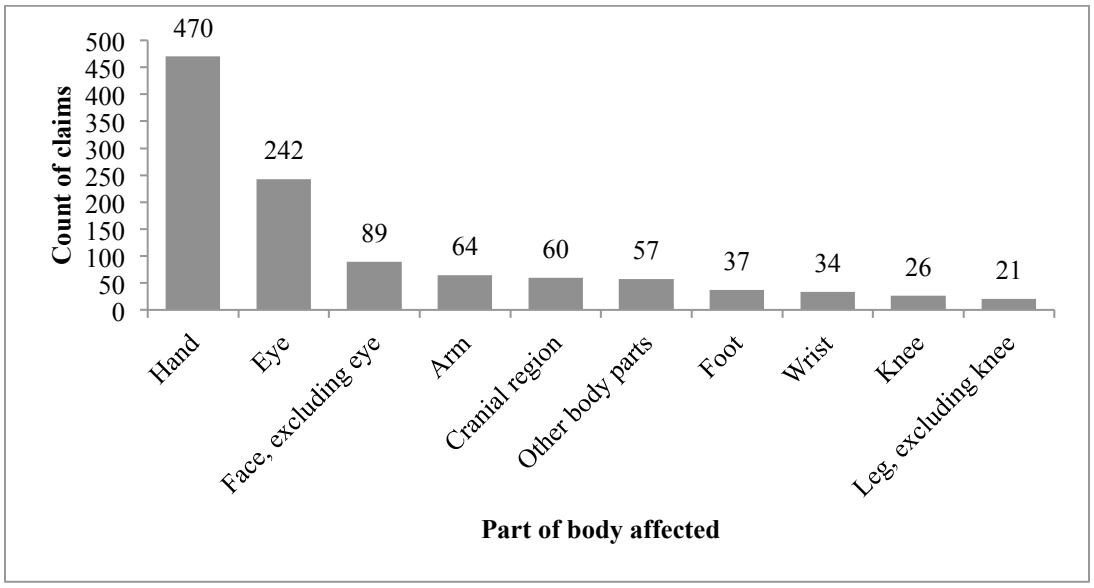

Figure 12. Contact with objects or equipment- claims by part of body affected

Table 13

Contact with Objects or Equipment- Leading Injuries by Count

ICD code	ICD description	Claims count
883	OPEN WOUND OF FINGER	165
882	OPEN WOUND OF HAND	99
918.1	CORNEAL ABRASION	85
930	FOREIGN BODY EXTERN EYE	82
923.2	CONTUSION OF WRIST/HAND	39
873	OTHER OPEN WOUND OF HEAD	36
920	CONTUSION FACE/SCALP/NCK	36
930.9	FOREIGN BDY EXT EYE NOS	22
923.3	CONTUSION OF FINGER	19
881	OPEN WOUND OF LOWER ARM	18
927.3	CRUSHING INJURY FINGER	18
873.42	OPEN WOUND OF FOREHEAD	17
873.43	OPEN WOUND OF LIP	14
883.1	OPEN WOUND FINGER-COMPL	13
883.2	OPEN WND FINGER W TENDON	13

5.6.1. Struck by object or equipment

Struck by object or equipment was the top category by event or exposure representing 34% of all claims. It ranked 4th in total claims cost with over $1.4 million. Major sources of injury (Figure 13) were scrap, waste, debris (36.0%), hand tools- non-powered (23.0%), vehicle and mobile equipment parts (15.4), and hand tools- power not determined (7.0%). The parts of the body most affected (Figure 14) were eyes (33.5%), hands (32.4%), the face excluding the eye (10.6%), and the arm (4.3%). Leading injuries in the struck by object or equipment classification were abrasions, foreign bodies to the eye, wounds, contusions, and crushing injuries. The most noteworthy injuries by count

(Table 14) were corneal abrasions (84), foreign bodies to the external eye (81), and open wounds of the finger (79). See Appendix K for leading injuries by total cost.

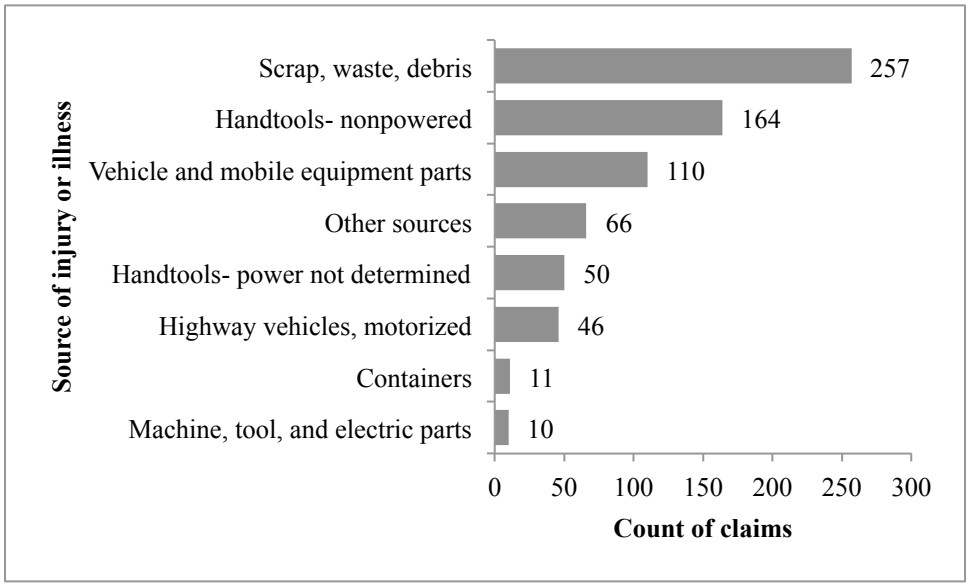

Figure 13. Struck by object or equipment- claims by source of injury or illness.

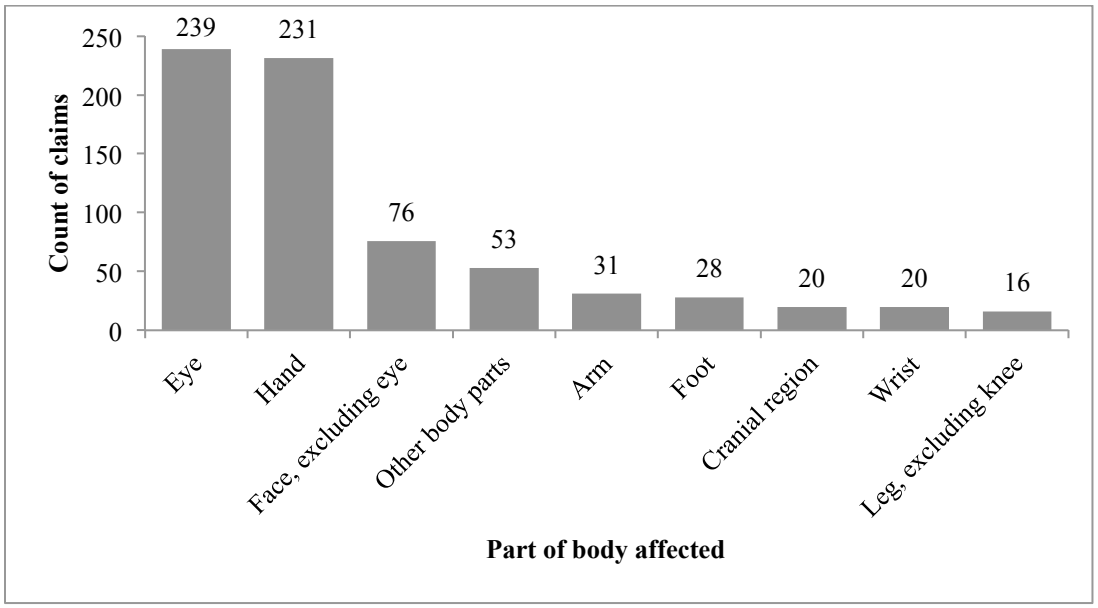

Figure 14. Struck by object or equipment- claims by part of body affected.

Table 14

Struck by Object or Equipment- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
918.1	CORNEAL ABRASION	84
930	FOREIGN BODY EXTERN EYE	81
883	OPEN WOUND OF FINGER	79
882	OPEN WOUND OF HAND	46
920	CONTUSION FACE/SCALP/NCK	26
923.2	CONTUSION OF WRIST/HAND	22
930.9	FOREIGN BDY EXT EYE NOS	22
873.43	OPEN WOUND OF LIP	14
873	OTHER OPEN WOUND OF HEAD	13
923.3	CONTUSION OF FINGER	12
873.42	OPEN WOUND OF FOREHEAD	11
924.2	CONTUSION ANKLE & FOOT	11
930.1	FB IN CONJUNCTIVAL SAC	10
927.3	CRUSHING INJURY FINGER	9

5.6.2. Struck against object or equipment

The category struck against object or equipment ranked fourth in claims by event or exposure. There was a little over $440,000 in total claims cost for this category. The source for the vast majority of claims was motorized highway vehicles at 61.1% (Figure 15). Material and personnel handling machinery at 7.1% and vehicle and mobile equipment parts at 4.6% were the next two contributing sources in this group. The primary body part affected was the hand which represented 55.5% of the claims (Figure 16). The greatest natures of injury were wounds, contusions, sprains, and concussions (Table 15). The most significant natures of injury were open wounds of the finger (70), open wounds of the hand (41), and other open wounds of the head (23). See Appendix L for the leading natures of injury by total cost.

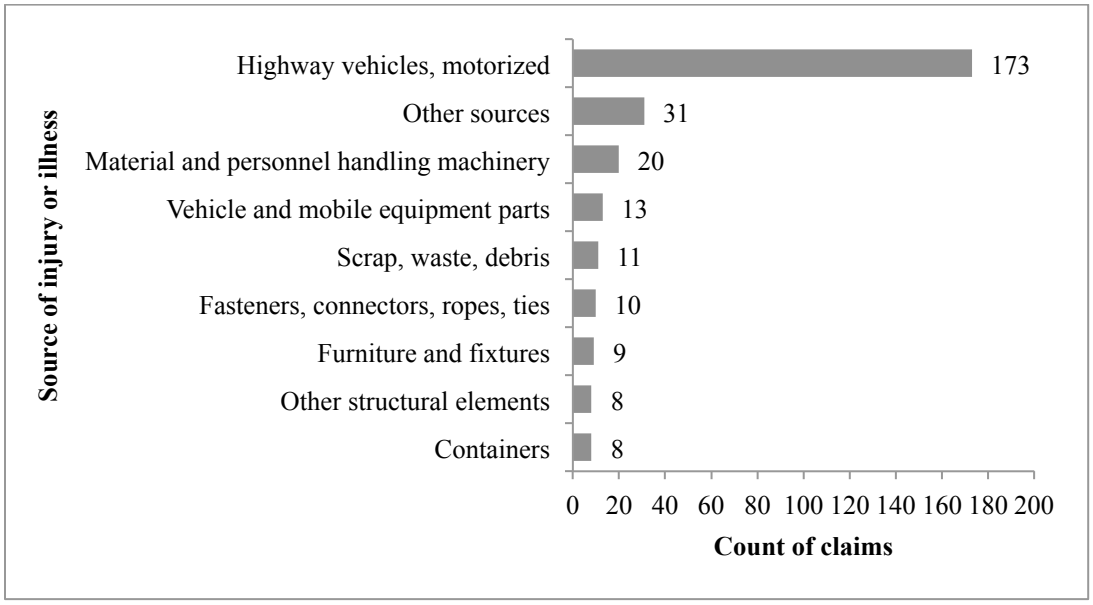

Figure 15. Struck against object or equipment- claims by source of injury or illness.

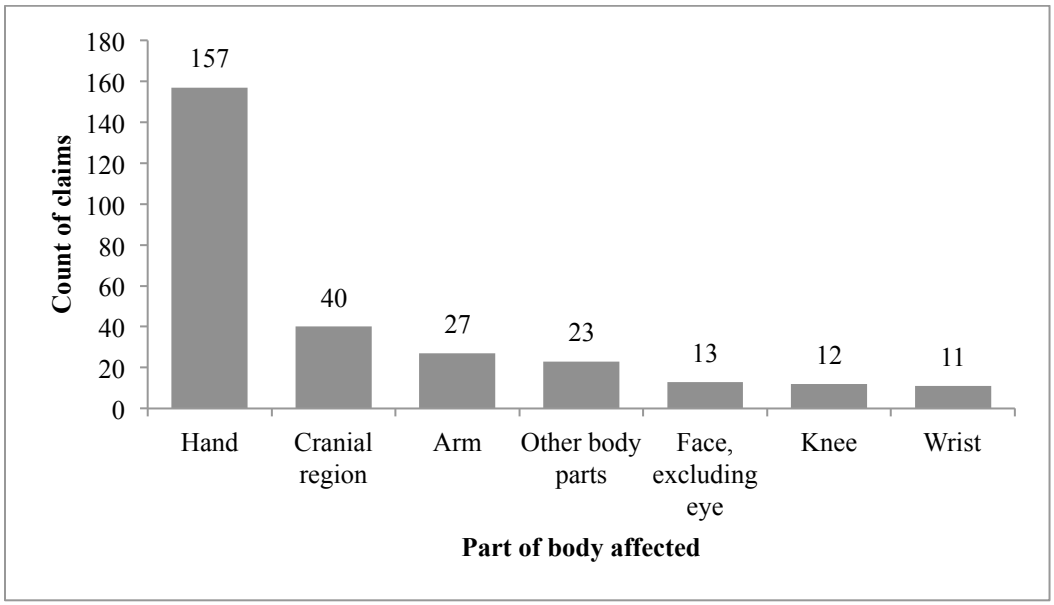

Figure 16. Struck against object or equipment- claims by part of body affected.

Table 15

Struck Against Object or Equipment- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
883	OPEN WOUND OF FINGER	70
882	OPEN WOUND OF HAND	41
873	OTHER OPEN WOUND OF HEAD	23
881	OPEN WOUND OF LOWER ARM	9
920	CONTUSION FACE/SCALP/NCK	9
923.2	CONTUSION OF WRIST/HAND	9
923.11	CONTUSION OF ELBOW	8
883.1	OPEN WOUND FINGER-COMPL	7
842.1	SPRAIN OF HAND	6
850	CONCUSSION	6
873.42	OPEN WOUND OF FOREHEAD	6
883.2	OPEN WND FINGER W TENDON	6
891	OPEN WND KNEE/LEG/ANKLE	5
892	OPEN WOUND OF FOOT	5
924.11	CONTUSION OF KNEE	5

5.6.3. Caught in or compressed by equipment or objects

There were 103 caught in or compressed by equipment or objects claims which accounted for 4.9% of all claims in the event or exposure category. The highest ranking sources of injury (Figure 17) were vehicles (37.9%), machinery (25.2%), parts and materials (13.6%), and tools, instruments, and equipment (11.7%). The number one body part affected was the hand which was involved in 79.6% of the claims (Figure 18). Top natures of injury included wounds, crushing injuries, contusions, fractures, sprains, and amputations (Table 16). See Appendix M for leading injuries by total cost.

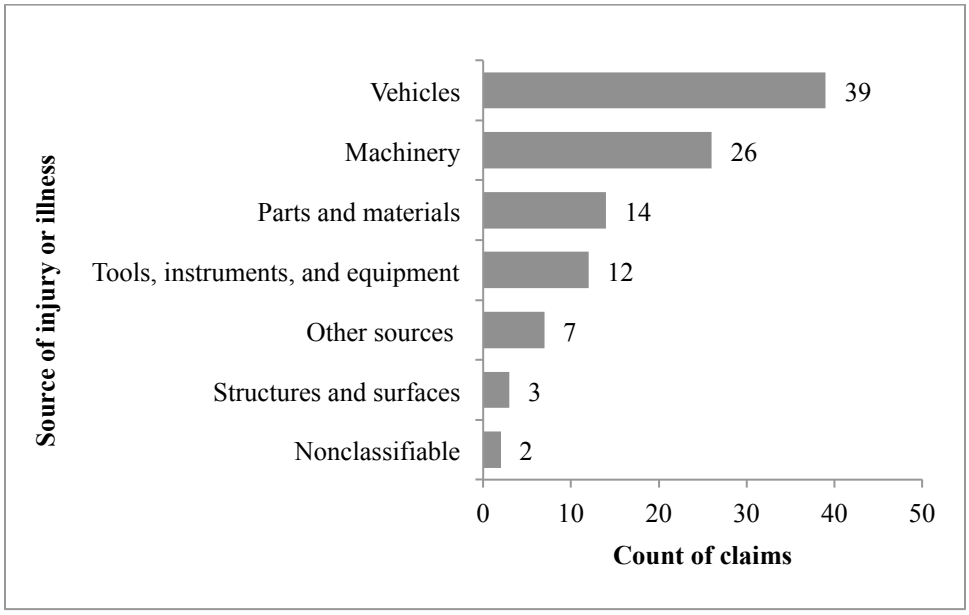

Figure 17. Caught in or compressed by equipment or objects- claims by source of injury or illness.

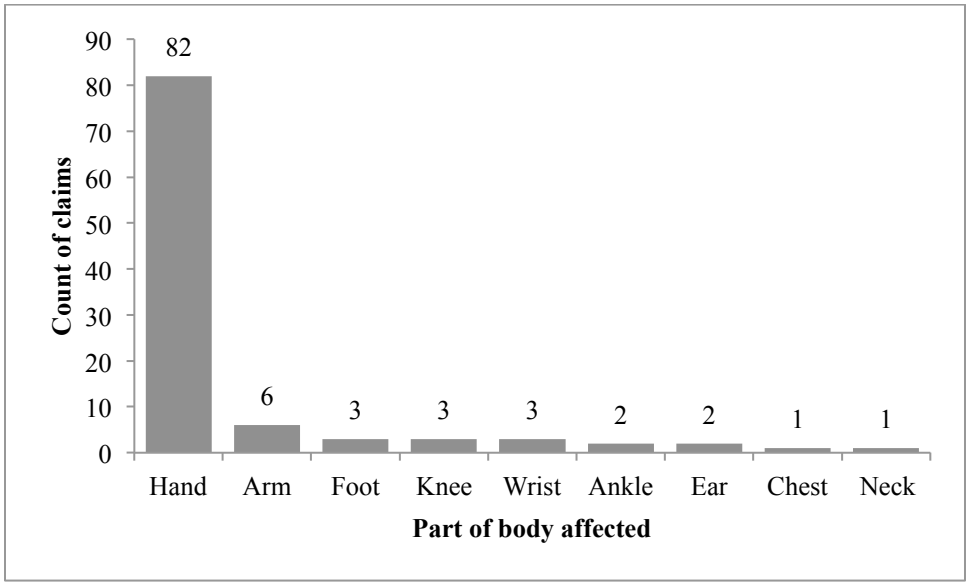

Figure 18. Caught in or compressed by equipment or objects- claims by part of body affected.

Table 16

Caught in or Compressed by Equipment or Objects- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
883	OPEN WOUND OF FINGER	16
882	OPEN WOUND OF HAND	12
927.3	CRUSHING INJURY FINGER	9
923.2	CONTUSION OF WRIST/HAND	8
816	FRACTURE PHALANGES, HAND	7
816.12	FX DISTAL PHAL, HAND-OPN	6
923.3	CONTUSION OF FINGER	3
927.2	CRUSHING INJ WRIST/HAND	3
816.02	FX DIST PHALANX, HAND-CL	2
816.11	FX MID/PRX PHAL, HAND-OP	2
842.1	SPRAIN OF HAND	2
883.1	OPEN WOUND FINGER-COMPL	2
886	TRAUM AMPUTATION FINGER	2
923.1	CONTUSION ELBOW/FOREARM	2
923.21	CONTUSION OF WRIST	2

5.7. Overexertion and bodily reaction

Overexertion and bodily reaction was the highest event or exposure by total cost. The total claims cost for this group was approximately $4.5 million. It also ranked second in the number of claims filed by event or exposure (446 out of 2,100 claims or 21.2%). The vast majority of claims in this category were due to overexertion involving outside sources (74.7%), followed by other exertions at 20.0% (Figure 19). The total cost for overexertion involving outside sources was a staggering $3.9 million. Other exertions or bodily reactions was at a much lower cost with nearly $370,000 (Table 17).

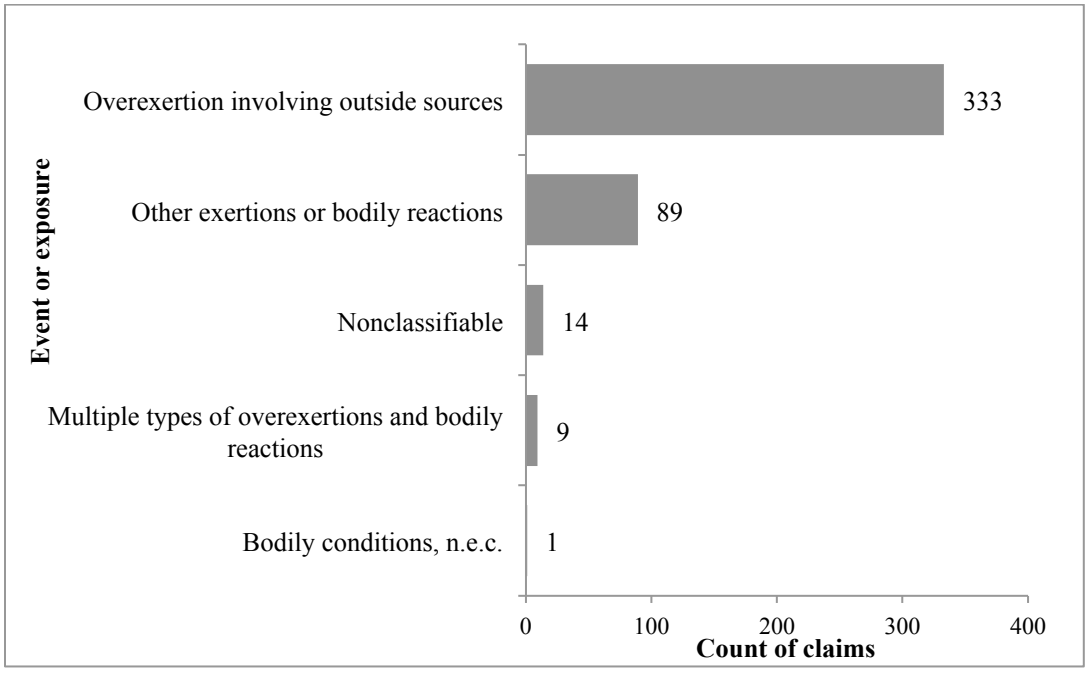

Figure 19. Overexertion and bodily reaction- claims by event or exposure.

Table 17

Overexertion and Bodily Reaction- Event or Exposure by Total Cost

Event or exposure	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Overexertion involving outside sources	1,625,222	921,315	1,380,572	3,927,109
Other exertions or bodily reactions	180,599	89,269	96,811	366,679
Non-classifiable	44,978	24,314	31,973	101,265
Multiple types of overexertions and bodily reactions	27,038	24,928	3,794	55,760
Bodily conditions, not elsewhere classified	4,966	0	0	4,966
Total	$1,882,802	$1,059,827	$1,513,150	$4,455,779

Moreover, parts and materials was the top source of injury or illness representing 47.3% of the claims due to overexertion or bodily reaction (Figure 20). Other sources included persons, plants, animals, and minerals (20.2%), tools, instruments, and equipment (12.8%), and containers, furniture, and fixtures (5.4%). The total cost for the source by injury or illness for this category can be found in Appendix N.

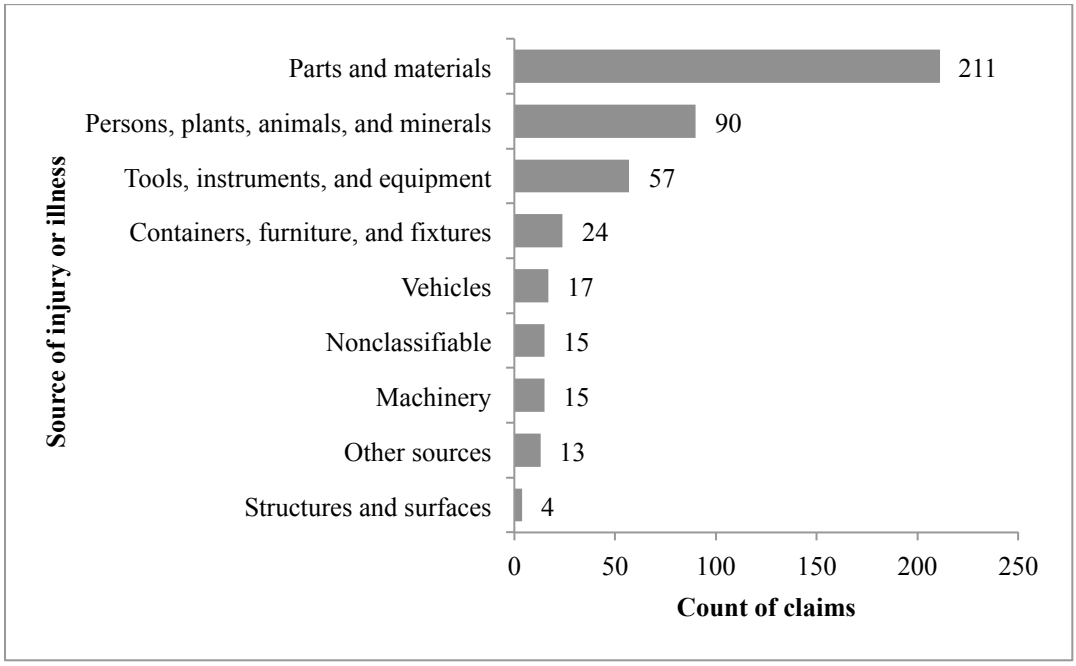

Figure 20. Overexertion and bodily reaction- claims by source of injury or illness.

Additionally, the back at 38.1% and the shoulder at 17.7% were the body parts most affected in the overexertion and bodily reaction classification (Figure 21). Other body parts injured were arms (7.0%), knees (7.0%), wrists (6.5%), pelvic regions (6.1%), and abdomens (5.8%). Cost data for parts of body affected are in Appendix O.

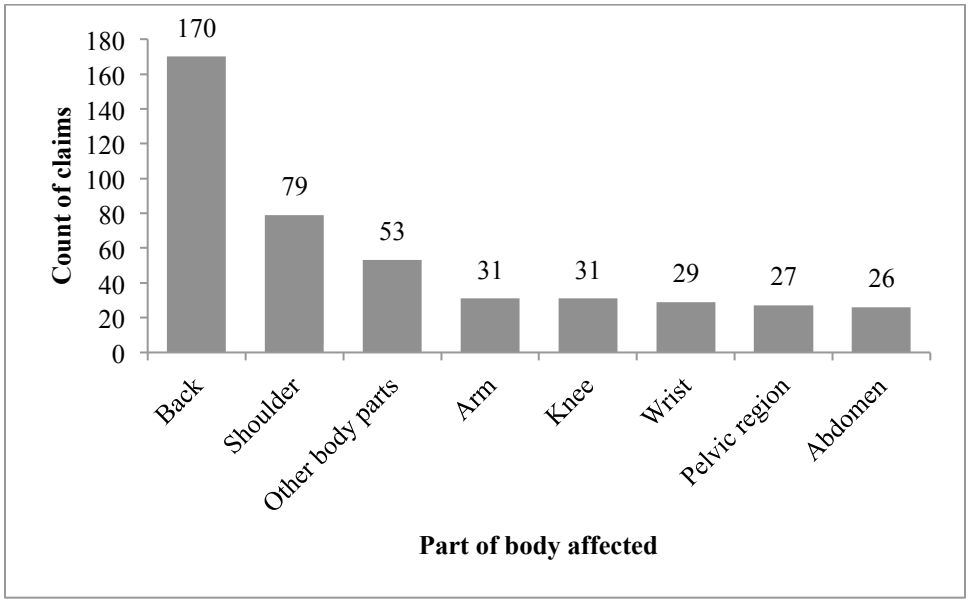

Figure 21. Overexertion and bodily reaction- claims by part of body affected.

Also, the most common natures of injury were sprains, hernias, disc displacements, rotator cuff syndrome, tenosynovitis, and mononeuritis to the upper limbs (Table 18). The leading injuries by count were sprains to the lumbar region (92), sprains to the shoulder or arm not otherwise specified (41), sprains to the sacroiliac region (39), inguinal hernias not otherwise specified (19), and other sprains not elsewhere classified (19). Cost data for nature of injury is displayed in Appendices P-S.

Table 18

Overexertion and Bodily Reaction- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
847.2	SPRAIN LUMBAR REGION	92
840.9	SPRAIN SHOULDER/ARM NOS	41
846	SPRAIN SACROILIAC REGION	39
550.9	INGUINAL HERNIA NOS	19
848.8	SPRAIN NEC	19
840.4	SPRAIN ROTATOR CUFF	18
844.9	SPRAIN OF KNEE & LEG NOS	18
722.1	THORAC/LUMB DISC DISPLAC	16
842	SPRAIN WRIST & HAND	15
847.1	SPRAIN THORACIC REGION	13
841.9	SPRAIN ELBOW/FOREARM NOS	12
840.8	SPRAIN SHOULDER/ARM NEC	9
726.1	ROTATOR CUFF SYNDR ET AL	8
727.05	TENOSYNOV HAND/WRIST NEC	8
354	MONONEURITIS UPPER LIMB	7

5.7.1 Overexertion involving outside sources

Overexertion involving outside sources, with a total cost of $3.9 million, was the most expensive event or exposure by subcategory. Likewise it was ranked second (15.9%) in the number of claims in the event or exposure subcategory. Injuries or illnesses in this classification are those where the overexertion is due to some physical effort being applied toward an outside source such as a technician injuring his back lifting a heavy piece of equipment. The top source of injury or illness in this category was vehicle and mobile equipment parts which represented 61.2% of the claims (Figure 22). Tires were involved in 27.3% of the claims filed. Other sources were non-powered hand

tools (10.5%), containers (6.3%), highway vehicles, motorized (4.5%) and powered hand tools (3.0%).

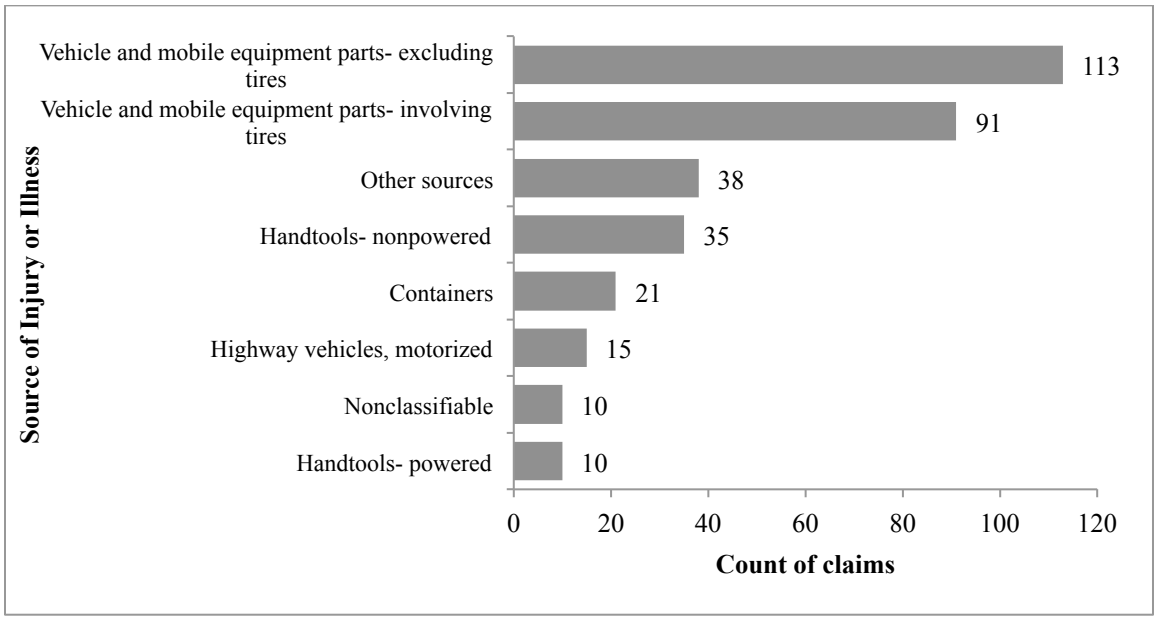

Figure 22. Overexertion involving outside sources- claims by source of injury or illness.

Furthermore, lifting or lowering was the number one type of overexertion (63.1%) followed by pushing, pulling, or turning (28.5%), throwing or catching (4.8%), and holding, carrying, or wielding at 1.8% (Figure 23). Injuries to the back accounted for 39.0% of the claims (Figure 24). Other body parts injured included shoulders (21.6%), arms (8.4%), abdomens (7.2%), and pelvic regions (7.2%). Types of injuries were sprains, hernias, disc displacements, rotator cuff syndrome, and tenosynovitis (Table 19). The leading injuries in this category (Table 19) were sprains to the lumbar region (70), sprains to the shoulder or arm not otherwise specified (37), sprains to the sacroiliac

region (27), and inguinal hernias not otherwise specified (19). See Appendix T for leading injuries by total cost.

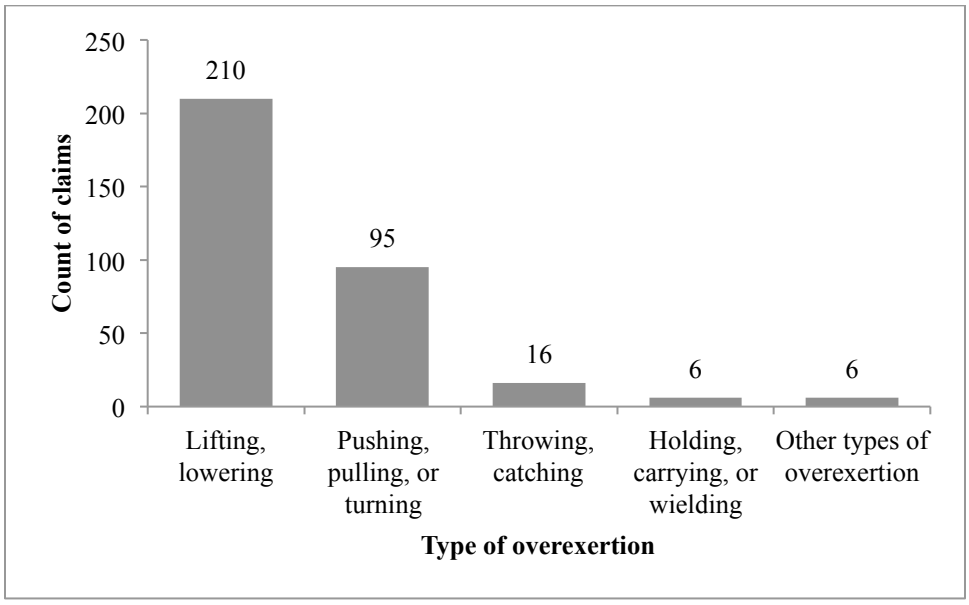

Figure 23. Overexertion involving outside sources- claims by type of overexertion.

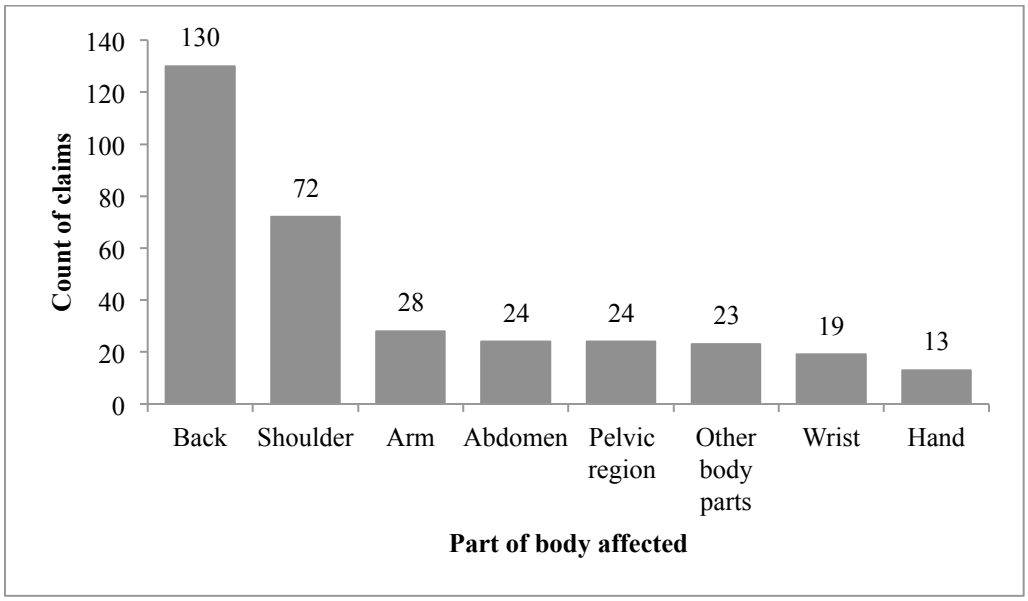

Figure 24. Overexertion involving outside sources- claims by part of body affected.

Table 19

Overexertion Involving Outside Sources- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
847.2	SPRAIN LUMBAR REGION	70
840.9	SPRAIN SHOULDER/ARM NOS	37
846	SPRAIN SACROILIAC REGION	27
550.9	INGUINAL HERNIA NOS	19
722.1	THORAC/LUMB DISC DISPLAC	16
840.4	SPRAIN ROTATOR CUFF	16
848.8	SPRAIN NEC	16
842	SPRAIN WRIST & HAND	14
841.9	SPRAIN ELBOW/FOREARM NOS	12
840.8	SPRAIN SHOULDER/ARM NEC	9
726.1	ROTATOR CUFF SYNDR ET AL	8
847.1	SPRAIN THORACIC REGION	8
727.05	TENOSYNOV HAND/WRIST NEC	5
844.9	SPRAIN OF KNEE & LEG NOS	5
847	SPRAIN OF BACK NEC/NOS	5
848.5	SPRAIN OF PELVIS	5

5.7.2. Other exertions and bodily reactions

Other exertions and bodily reactions represented 4.2% of total claims by event or exposure with nearly $370,000 in total claims cost. According to the BLS coding system, the source of injury or illness for this category is the bodily motion or position of the injured or ill worker. The types of exertions or bodily reaction (Figure 25) were multiple types of exertions and bodily reactions (25.8%), bending (22.5%), twisting (12.4%), stepping (9.0%), and kneeling or kneeling down (7.9%). The body parts most affected (Figure 26) was backs (38.2%), knees (27.0%), ankles (6.7%), chests (6.7%), and shoulders (5.6%). The top natures of injury were sprains, dislocations, and contusions (Table 20). Other significant injuries were sprains to the lumbar region (17), sprains to

the knee and leg not otherwise specified (12), and sprains to the sacroiliac region (12). Leading claims by total cost can be found in Appendix U.

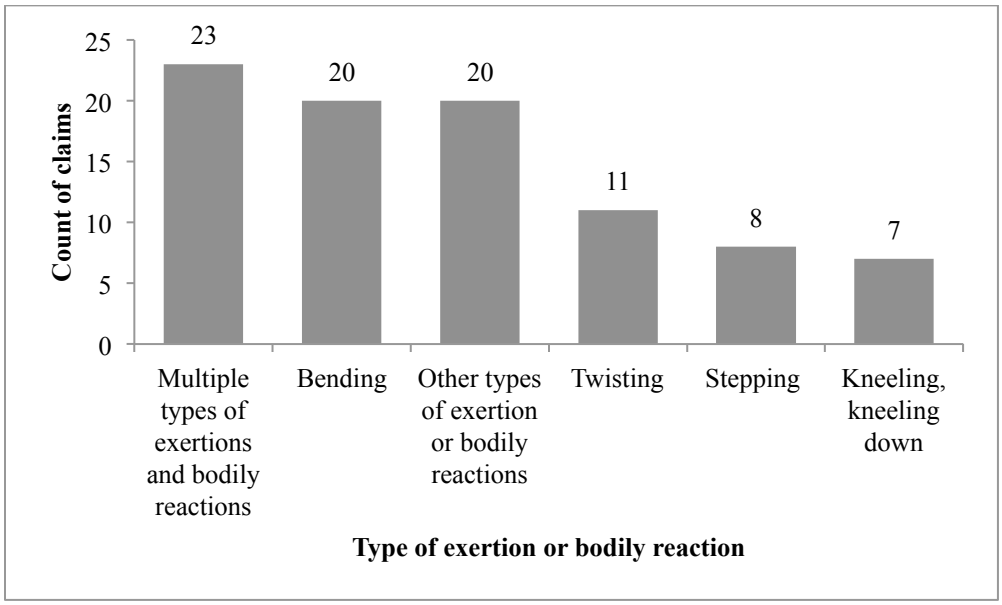

Figure 25. Claims by type of exertion or bodily reaction.

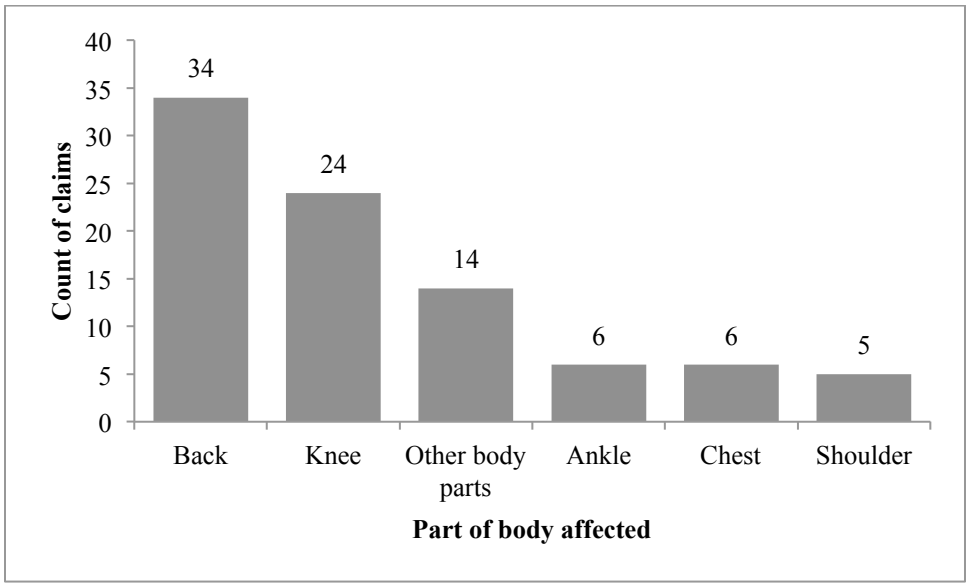

Figure 26. Other exertions and bodily reactions- claims by part of body affected.

Table 20

Other Exertions and Bodily Reactions- Leading Injuries by Claims Count

ICD code	ICD description	Count
847.2	SPRAIN LUMBAR REGION	17
844.9	SPRAIN OF KNEE & LEG NOS	12
846	SPRAIN SACROILIAC REGION	12
845	SPRAIN OF ANKLE & FOOT	5
836	DISLOCATION OF KNEE	4
840.9	SPRAIN SHOULDER/ARM NOS	4
847.1	SPRAIN THORACIC REGION	4
844.2	SPRAIN CRUCIATE LIG KNEE	2
848.3	SPRAIN OF RIBS	2
848.8	SPRAIN NEC	2
922.1	CONTUSION OF CHEST WALL	2

5.8. Falls, slips, trips

Falls, slips, and trips was ranked second in total cost with a little over $4.4 million in total claims cost. This class represented 14.5% of all claims. There were 304 claims classified as falls, slips, and trips. The majority of the claims (50.3%) were due to falls on the same level (Figure 27). The next category by claims count was falls to lower level (32.2%) followed by slip or trip without fall (15.1%). Falls to lower level had the highest total cost at nearly $2.0 million dollars (Table 21). Other notable categories were falls on the same level with approximately $1.7 million and slip or trip without fall at $720,000 in total cost.

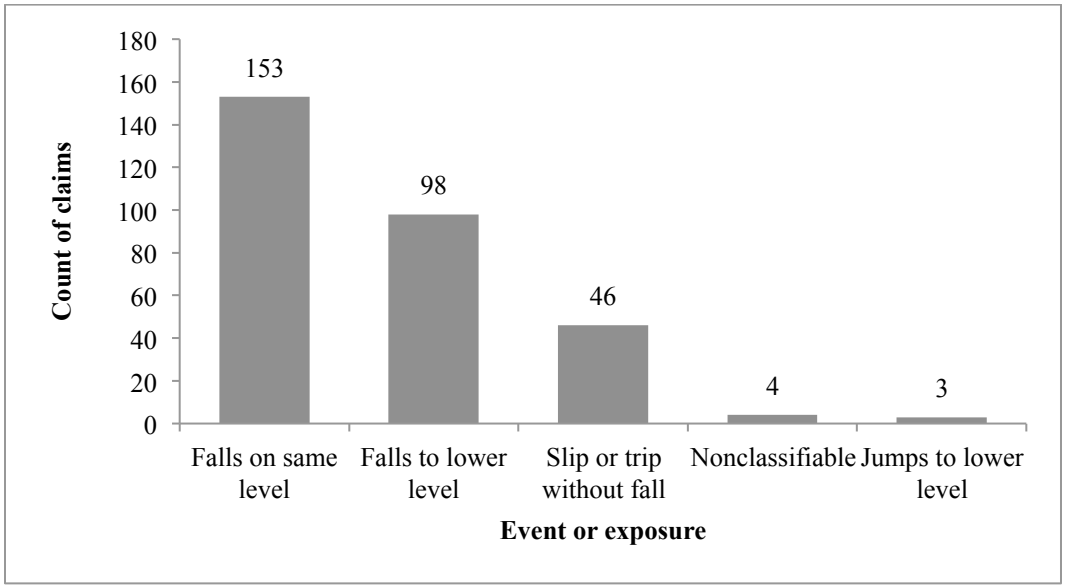

Figure 27. Falls, slips, trips- claims by event or exposure.

Table 21

Falls, Slips, Trips- Event or Exposure by Total Cost

Event or exposure	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Falls to lower level	656,117	312,992	1,029,969	1,999,078
Falls on same level	799,251	389,289	487,172	1,675,713
Slip or trip without fall	231,204	194,912	294,687	720,804
Jumps to lower level	29,914	9,023	0	38,937
Non-classifiable	5,915	0	0	5,915
Total	$1,722,402	$906,216	$1,811,828	$4,440,446

Additionally, the number one source of injury (Figure 28) was structures and surfaces (61.5%). Other leading sources of injury were persons, plants, animals, and minerals (12.8%), vehicles (12.5%), and tools, instruments, and equipment (6.6%). Cost by source of injury is listed in Appendix V.

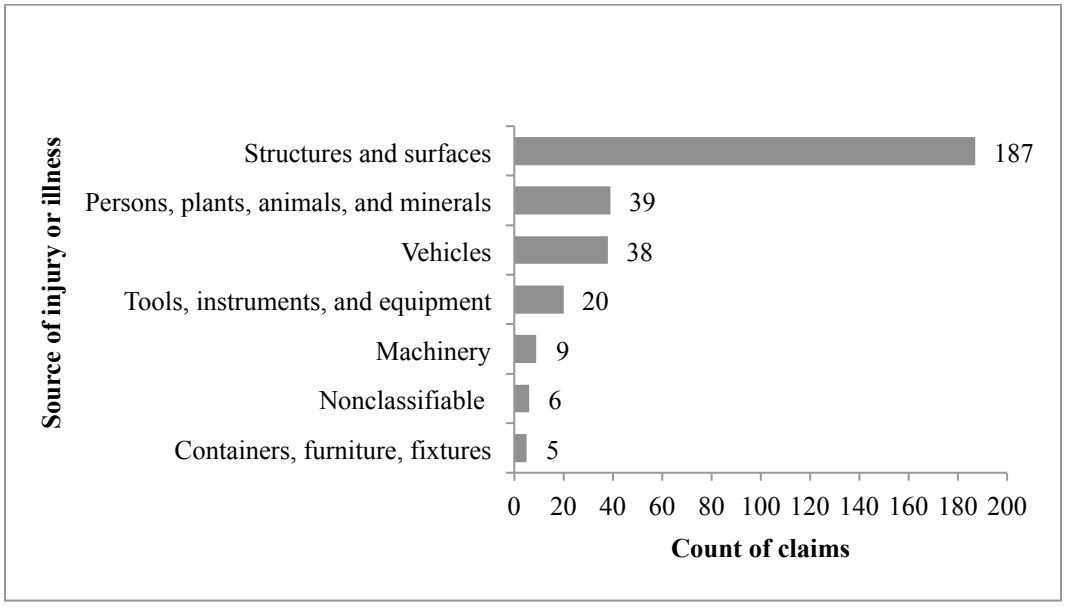

Figure 28. Falls, slips, trips- claims by source of injury or illness.

Lastly, the top body parts affected (Figure 29) were backs (20.1%), knees (12.8%), ankles (11.5%), and shoulders (9.9%). Appendix W contains a detailed list of costs by body parts. The natures of injury for the top claims by count were sprains, contusions, and disc displacements (Table 22). Leading injuries by claims count were sprains to the lumbar region (31), sprains of the ankle and foot (24), and sprains to the knees and leg not otherwise specified (15). Cost data on nature of injury can be found in Appendices X-AA.

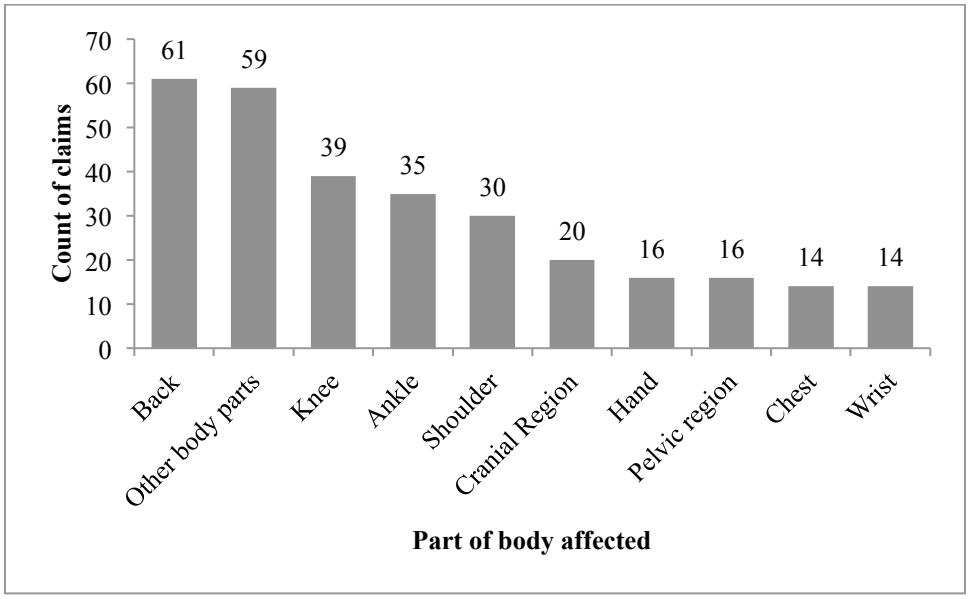

Figure 29. Falls, slips, trips- claims by part of body affected.

Table 22

Falls, Slips, Trips- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
847.2	SPRAIN LUMBAR REGION	31
845	SPRAIN OF ANKLE & FOOT	24
844.9	SPRAIN OF KNEE & LEG NOS	15
922.1	CONTUSION OF CHEST WALL	12
840.4	SPRAIN ROTATOR CUFF	11
847	SPRAIN OF BACK NEC/NOS	11
924.11	CONTUSION OF KNEE	10
722.1	THORAC/LUMB DISC DISPLAC	8
840.9	SPRAIN SHOULDER/ARM NOS	8
922.31	CONTUSION OF BACK	8
920	CONTUSION FACE/SCALP/NCK	8

5.8.1. Falls on Same Level

Falls on the same level ranked third in total cost with approximately $1.7 million in claims cost. There were 153 falls on the same level totaling half of all falls, slips, and

trips claims. According to the BLS, the source for falls on the same level is the surface on or from which the injured worker fell. The greatest sources of injury for falls on the same level (Figure 30) were parking lot (32%), floor (31.4%), and the ground (5.2%). BLS defines the secondary source as the object or substance contributing to the fall. The secondary source noted in the vast majority of cases was ice or snow at 48.4%. Other sources included chemical products (7.8%), parts and materials (6.5%), and water (4.6%). See Figure 31 for the secondary sources of injury.

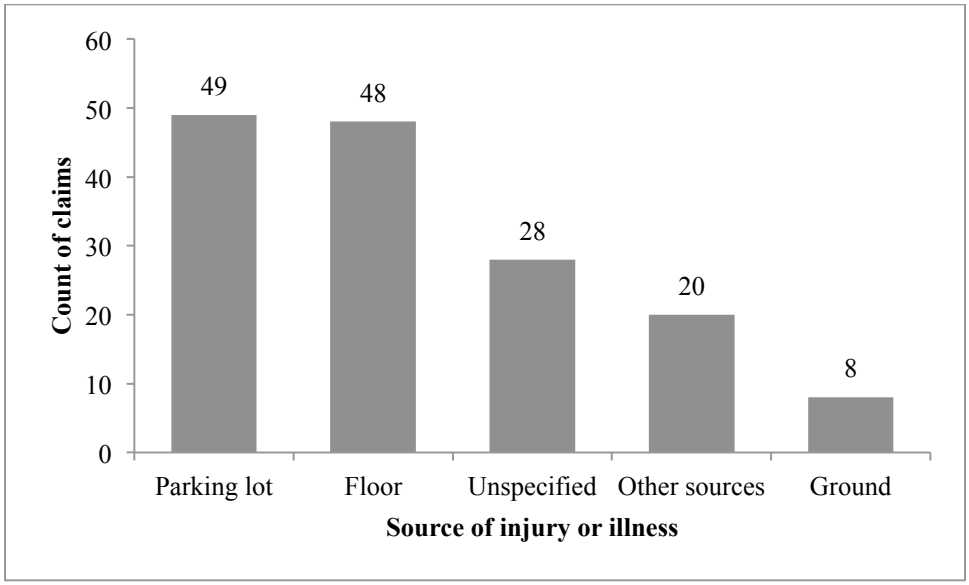

Figure 30. Falls on same level- claims by source of injury or illness.

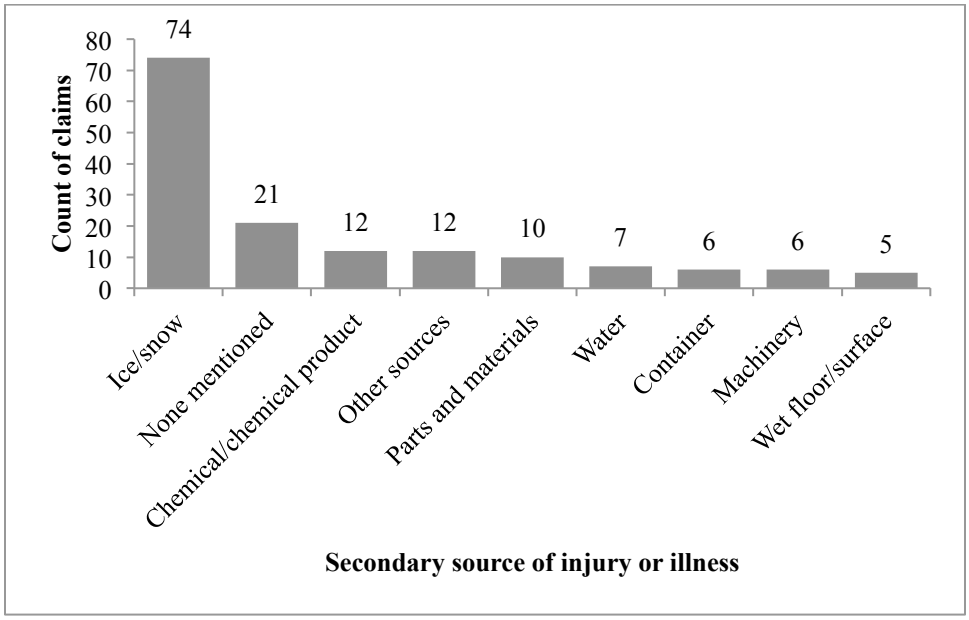

Figure 31. Falls on same level- claims by secondary source of injury or illness.

Furthermore, there were several body parts affected by falls on same level (Figure 32). The most significant body parts injured were backs (18.3%), shoulders (13.7%), knees (11.1%), cranial regions (8.5%), and wrists (7.8%). Top natures of injury were sprains, concussions, contusions, and disc displacements (Table 23). Injuries with the greatest claims count were sprains to the lumbar region (14), contusions of the chest wall (9), contusions of the knee (9), sprains to the rotator cuff (8), and sprains of the back not elsewhere classified or not otherwise specified (8). Leading injuries by total cost are listed in Appendix BB.

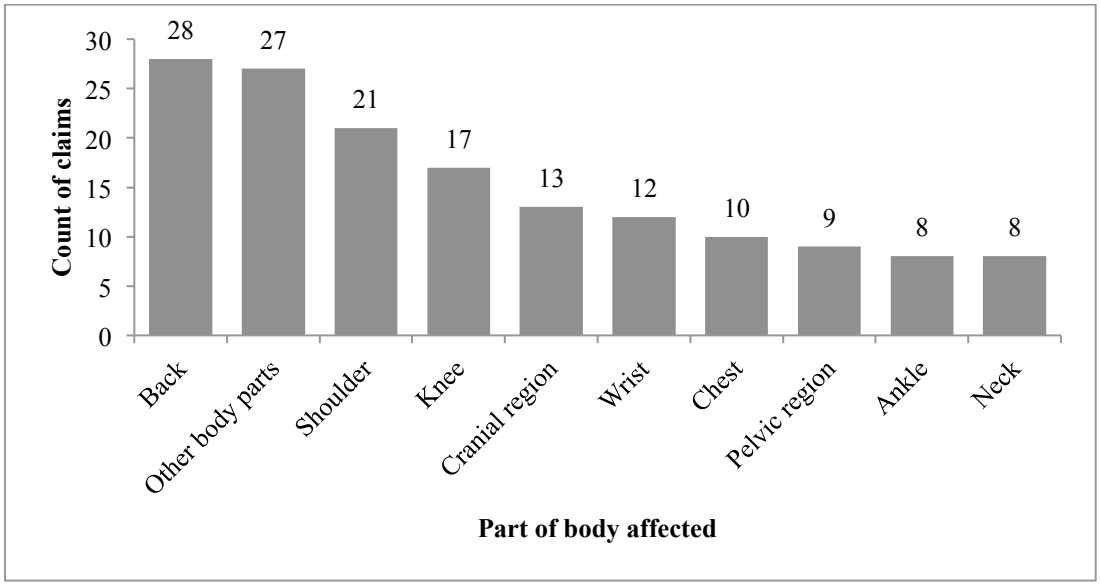

Figure 32. Falls on same level- claims by part of body affected.

Table 23

Falls on Same Level- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
847.2	SPRAIN LUMBAR REGION	14
922.1	CONTUSION OF CHEST WALL	9
924.11	CONTUSION OF KNEE	9
840.4	SPRAIN ROTATOR CUFF	8
847	SPRAIN OF BACK NEC/NOS	8
840.9	SPRAIN SHOULDER/ARM NOS	5
842	SPRAIN WRIST & HAND	5
844.9	SPRAIN OF KNEE & LEG NOS	5
920	CONTUSION FACE/SCALP/NCK	5
922.31	CONTUSION OF BACK	5
850	CONCUSSION	4
924.01	CONTUSION OF HIP	4
722.1	THORAC/LUMB DISC DISPLAC	3
842.1	SPRAIN WRIST & HAND	3
845	SPRAIN OF ANKLE & FOOT	3
846	SPRAIN SACROILIAC REGION	3

5.8.2. Falls to lower level

Falls to the lower level was the second highest overall event or exposure cost subcategory generating a total claims cost of approximately $2.0 million. However, falls to lower level only accounted for 4.7% of all claims. There were 98 claims in this category. According to the BLS, the source of injury for this category is the structural element or equipment through or from which the injured worker fell. The greatest sources of injury (Figure 33) included motorized highway vehicles (28.6%), floors, walkways, and ground surfaces (20.4%), and ladders (18.4%). The body parts most affected was backs (25.5%), knees (13.3%), ankles (12.2%), and the cranial and pelvic regions both at 7.1% (Figure 34). The most common types of injuries were sprains and contusions (Table 24). Leading injuries in the falls to lower level category were sprains to the lumbar region (12), sprains of the ankle and foot (10), and sprains of the knee and leg (6). Data on the leading claims by total cost is listed in Appendix CC.

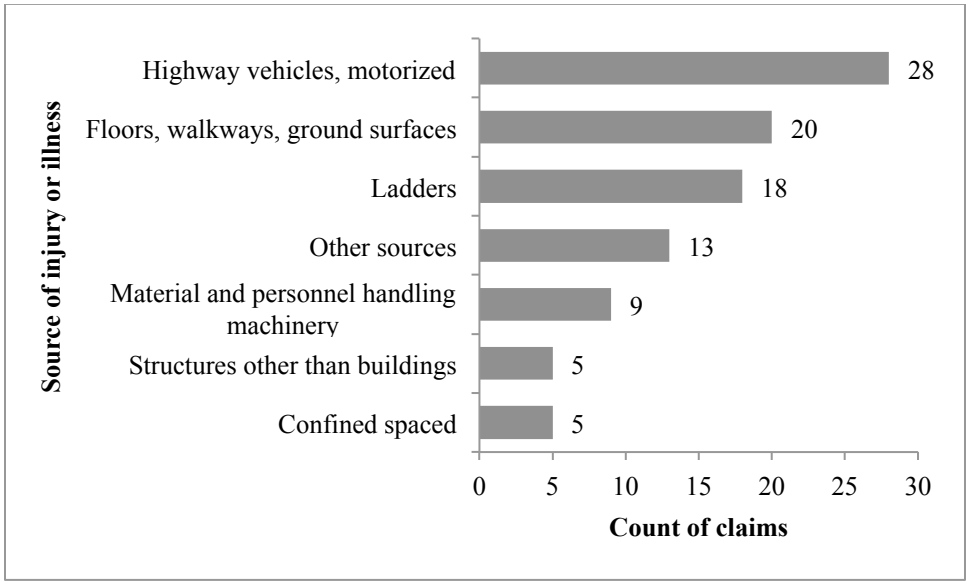

Figure 33. Falls to lower level- claims by source of injury or illness.

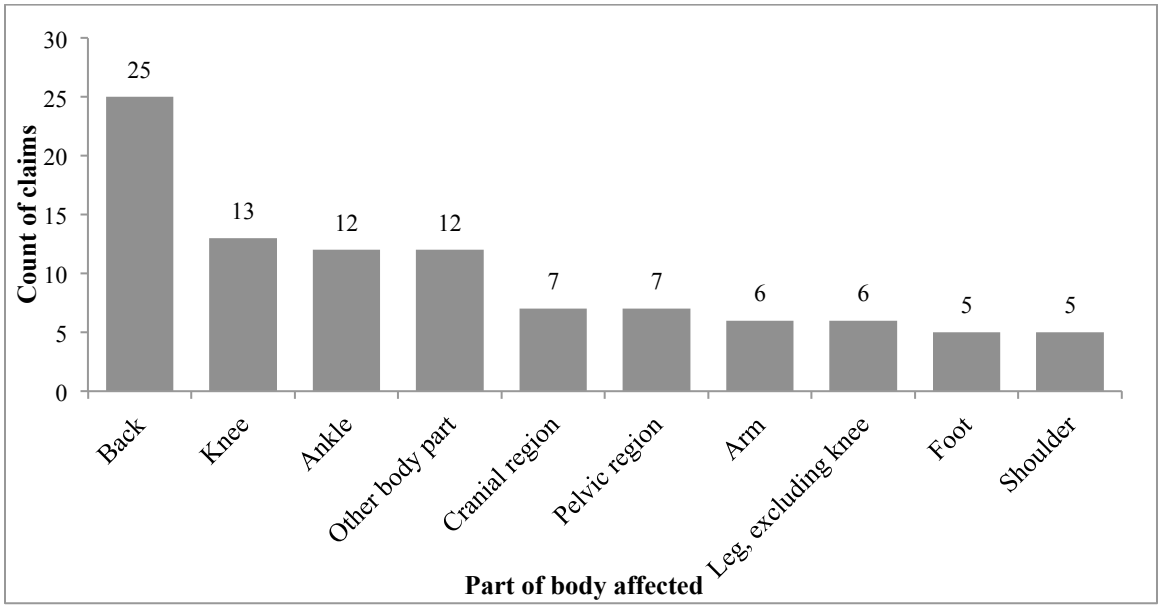

Figure 34. Falls to lower level- claims by part of body affected

Table 24

Falls to Lower Level- Leading Injuries by Claims Count

ICD code	ICD description	Claims count
847.2	SPRAIN LUMBAR REGION	12
845	SPRAIN OF ANKLE & FOOT	10
844.9	SPRAIN OF KNEE & LEG NOS	6
844.2	SPRAIN CRUCIATE LIG KNEE	4
846	SPRAIN SACROILIAC REGION	4
845.1	SPRAIN OF FOOT	3
920	CONTUSION FACE/SCALP/NCK	3
922.31	CONTUSION OF BACK	3
924.01	CONTUSION OF HIP	3

5.9. Research Question 1- How does the rate of overexertions in relationship to other injuries compare by age?

For this research question, the rate of overexertions and bodily reactions in relationship to other injuries was calculated by age groups. The results are displayed in

Figure 35. The number of overexertions increased with age for the younger age groups, peaking at the 35-44 age group which had an injury rate of 25.2%. The percentage of injuries then declined for the older age groups starting with the 45-54 age group which had a 23.4% injury rate. The 65+ (11.1%) and 16-19 (9.1%) age groups both had a low percentage of injuries in comparison to the other age groups.

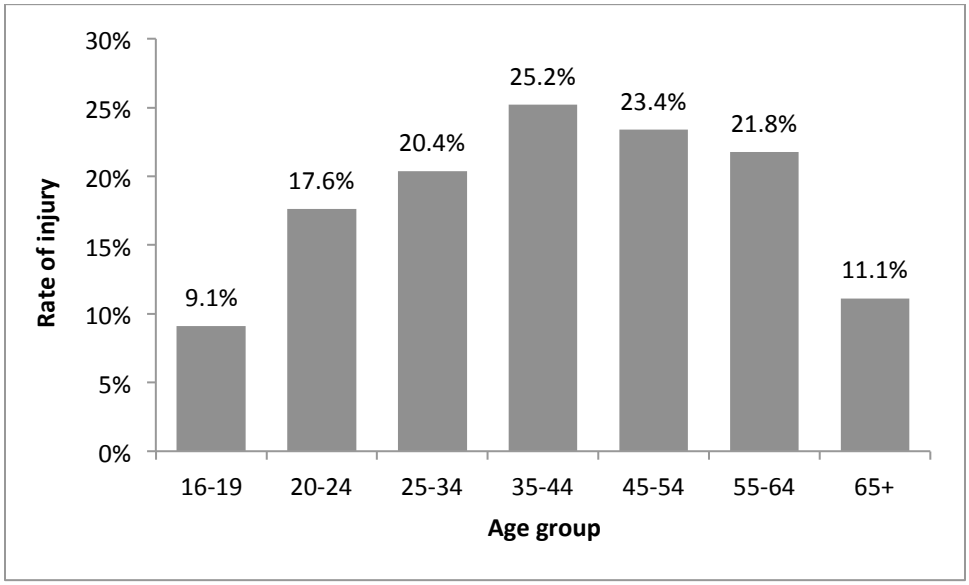

Figure 35. Rate of overexertions in relationship to other injuries by age.

5.10. Research Question 2- How does the rate of falls, slips, and trips in relationship to other injuries compare by age?

The rate of falls, slips, and trips in relationship to other injuries was calculated by age group for this research question. As indicated in Figure 36, the rate of falls, slips, and trips increased with age. However, the change between some age groups was relatively small. The 16-19 (10.2%) and 20-24 (10.3%) age groups had the lowest rates

of injury. On the other hand, the 65+ age group had a high percentage of overexertions with 40.7% of all injuries being due to overexertion in that age category.

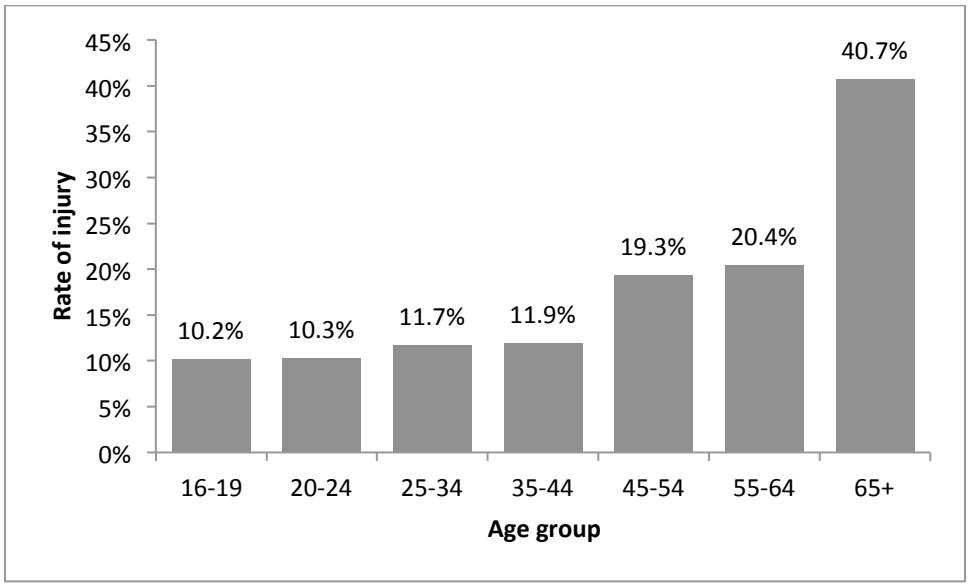

Figure 36. Rate of falls, slips, and trips in relationship to other injuries by age.

5.11. Research Question 3- How does the rate of contact with objects or equipment in relationship to other injuries compare by age?

For this research question, the rate of contact with objects or equipment in relationship to other injuries was calculated for each age group. The percentage of injuries due to contact with objects or equipment decreased with age (Figure 37). The rate of injury for the youngest age group was 63.6% as compared to the oldest age group, 65+, which had the lowest rate at 29.6%

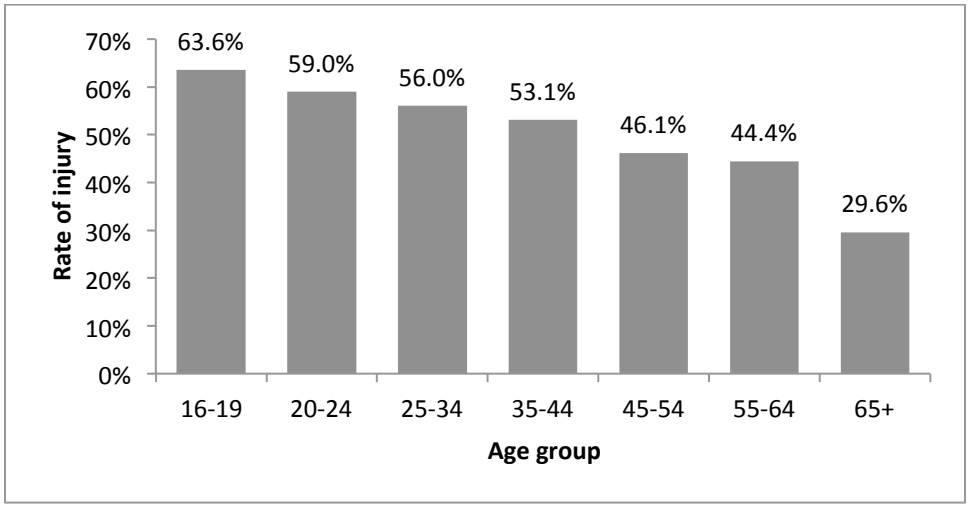

Figure 37. Rate of contact with objects or equipment in relationship to other injuries by age.

5.12. Research Question 4- What is the relationship between age and cost for overexertions?

For this research question, the percentage of overexertion and bodily reaction claims by total cost was determined by age groups. Table 25 shows the dispersion of claims by total cost and age for this category. The majority of claims fell into the 25-34, 35-44, and 45-54 age groups. A little over 60% of cost was in the under $2,000 cost group.

In addition, a chi-square test was performed to analyze the summary levels of cost and age in the overexertion and bodily reaction category. Results indicated a significant relationship between cost and age (chi-square=31.605, degrees of freedom=12, and p-value=.002). The percentage of certain cost distributions were not the same; therefore, it was determined that age does affect cost.

Table 25

Claims count of overexertion and bodily reactions by total cost and age

	Cost group				
Age group	< 2 K	2K- 10K	10K-50K	50K-250K	Total claims
16-19	7	0	1	0	8
20-24	46	7	2	0	55
25-34	71	19	13	5	108
35-44	67	25	19	3	114
45-54	52	30	19	8	109
55-64	28	9	6	6	49
65+	1	0	2	0	3
Total claims	272	90	62	22	446

For all but one age group, the percentage of overexertion and bodily reaction claims decreased with age in the under $2,000 cost group (Figure 38). The only exception to this was the 55-64 age group which had 57.1% of its claims in this cost group compared to the 45-44 age group at 47.7%. For the $2,000-$10,000 cost groups (Figure 39), the percentage of overexertion and bodily reaction claims increased with age amongst all age groups except the 55-64 group which dropped off to 18.4% in comparison to the 45-54 age groups which was at 27.5%. There were no claims in the 16-19 and 65+ age groups for this cost category.

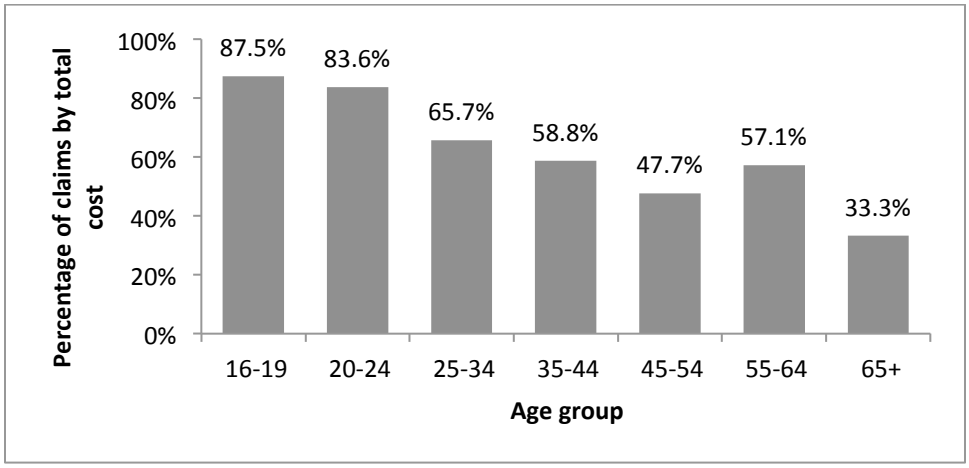

Figure 38. Percentage of overexertion and bodily reaction claims with total cost <2K by age.

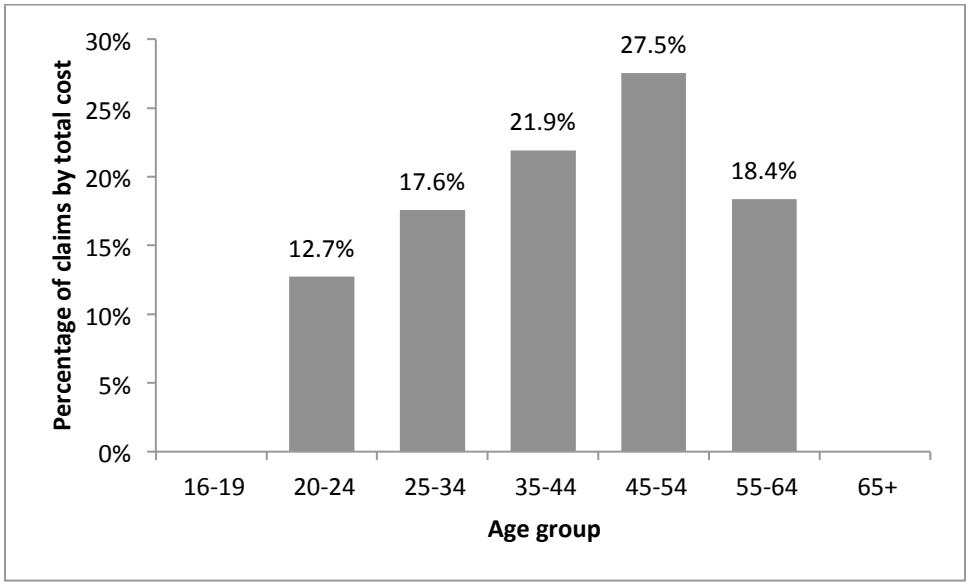

Figure 39. Percentage of overexertion and bodily reaction claims with total cost in the 2K-10K range by age.

In continuance, with exceptions of the change between the 16-19 (12.5%) and 20-24 (3.6%) age groups as well as the 45-54 (17.4%) and 55-64 (12.2%) age groups, there was a rise in the percentage of overexertion and bodily reaction claims in the $25,000-

$50,000 cost group (Figure 40). The largest percentage of claims was in the 65+ category which was at 66.7%. In addition, there were no claims in the 16-19, 20-24, and 65+ age groups in the $50,000-$250,000 cost group. The percentage of overexertion and bodily reaction claims increased with age for the age groups represented with exception of a slight decrease in the percentage of claims between the 25-34 (4.6%) and 35-44 (2.6%) age groups (Figure 41).

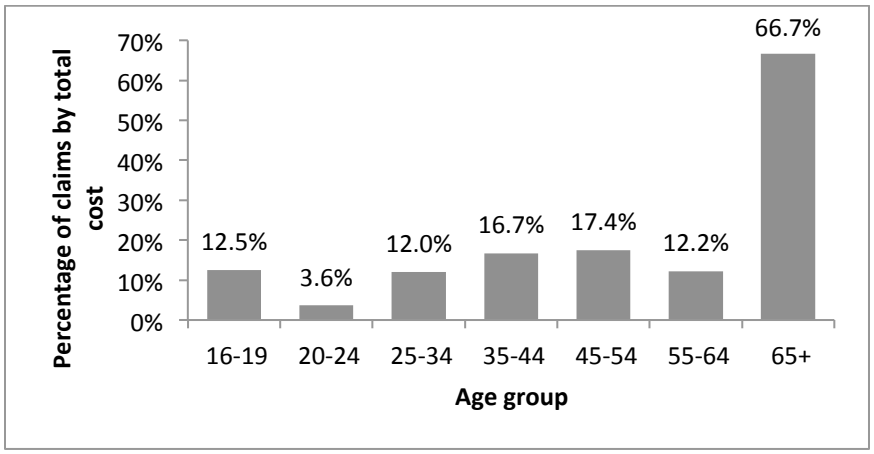

Figure 40. Percentage of overexertion and bodily reaction claims with total cost in the 25K-50K range by age.

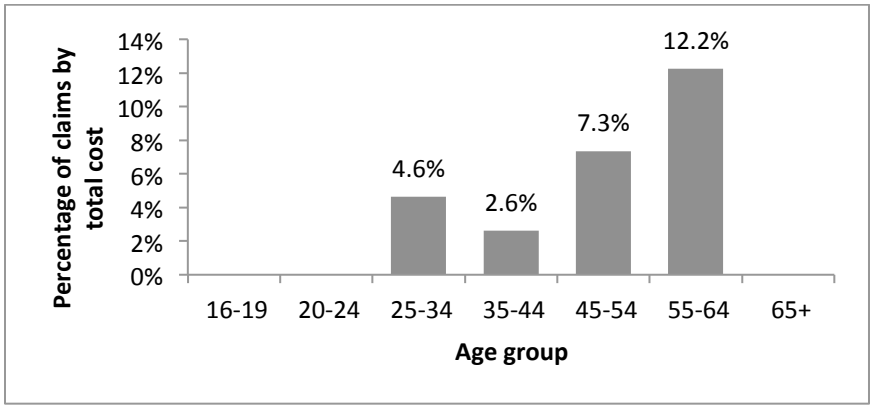

Figure 41. Percentage of overexertion and bodily reaction claims with total cost in the 50K-250K range by age.

5.13. Research Question 5- What is the relationship between age and cost for falls, slips, and trips?

For this research question, the percentage of falls, slips, and trips claims by total cost was determined by age groups. The number of claims by cost and age groups is displayed in Table 26. The greatest number of claims was in the 45-54 age group. There were far less claims in the 16-19 and 65+ age groups in comparison to the other groups. Also, approximately 62% of cost was in the under $2,000 cost group. It is important to note that a chi square test could not be performed for this category without losing the value of the data.

Table 26

Claims count of falls, slips, and trips by total cost and age

	Cost groups					
Age groups	< 2 K	2K- 10K	10K-50K	50K-250K	250K+	Total claims
16-19	7	2	0	0	0	9
20-24	23	4	4	1	0	32
25-34	44	11	5	2	0	62
35-44	34	5	8	6	1	54
45-54	43	24	11	11	1	90
55-64	27	10	7	2	0	46
65+	9	1	0	1	0	11
Total claims	187	57	35	23	2	304

As indicated in Figure 42, the percentage of fall, slip, and trip claims with total cost less than $2,000 declined for the first five age groups but raised for the 55-64 and 65+ age groups. The age group with the highest percentage of claims in this cost bracket

was 65+ with 81.8% as compared to the lowest percentage (47.8%) in the 45-54 age group.

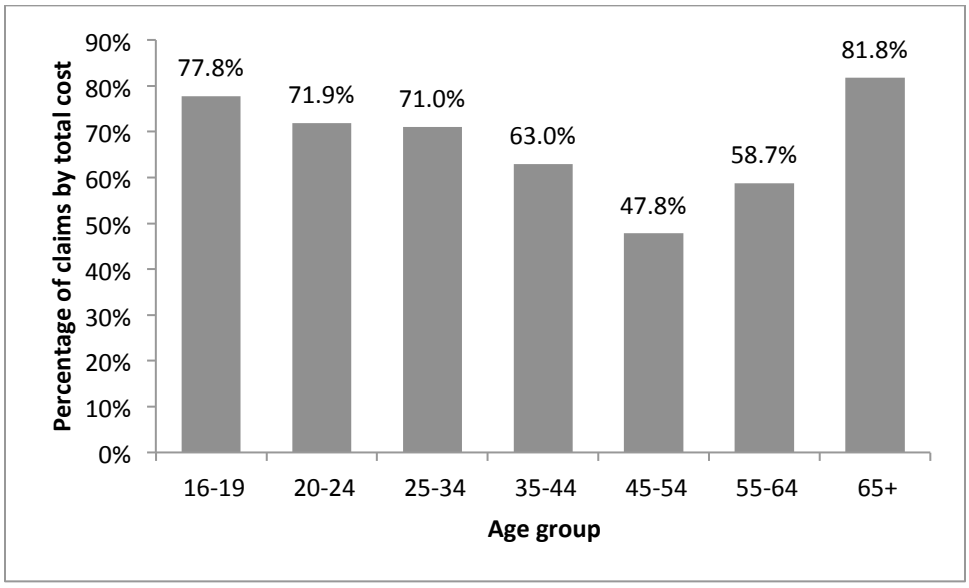

Figure 42. Percentage of falls, slips, and trips claims with total cost <2K by age.

On the other hand, the percentage of falls, slips, and trips did not seem to follow a definite pattern for the remainder of the cost groups. For the $2,000-$10,000 cost range, the percentage of falls, slips, and trips decreased from the 16-19 (22.2%) to the 35-44 (9.3%) age groups with the exception of the 20-24 (12.5%) age group (Figure 43). There was a surge from the 35-44 (9.3%) to the 45-54 (26.7%) age groups. The percentage of claims then lessened from the 45-54 to the 65+ (9.1%) age groups. The percentage of claims alternated between decreasing and increasing in the $10,000-$50,000 cost group (Figure 44). The lowest percentage of claims was in the 25-34 (8.1%) age group and the highest percentage was in the 55-64 (15.2%) age group. For the $50,000-$250,000 cost group, the percentage of claims became greater from the 20-24 (3.1%) age group to the

45-54 (12.2%) age group and then dropped to 4.3% for the 55-64 group (Figure 45). There was a rise to 9.1% for the 65+ group. The $250,000 cost group included 2 claims which represented less than 1% of all claims.

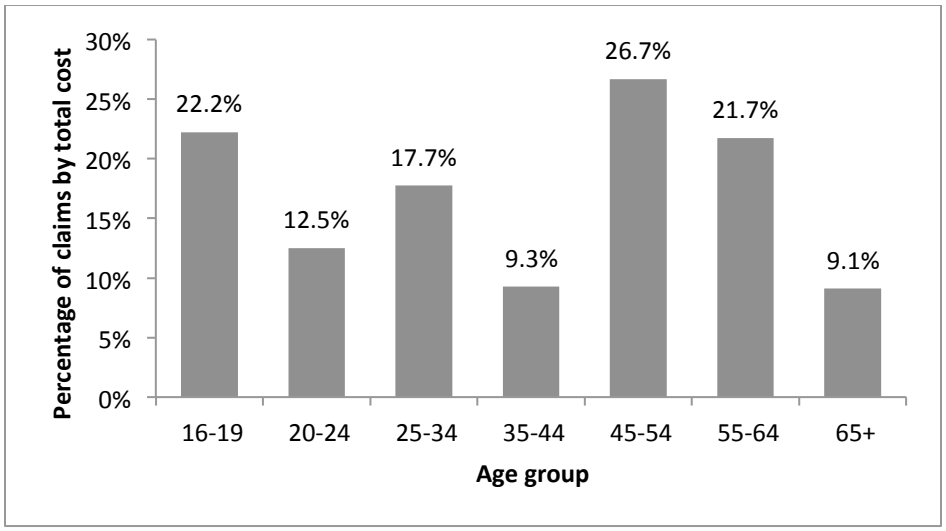

Figure 43. Percentage of falls, slips, and trips claims with total cost in the 2K-10K range by age.

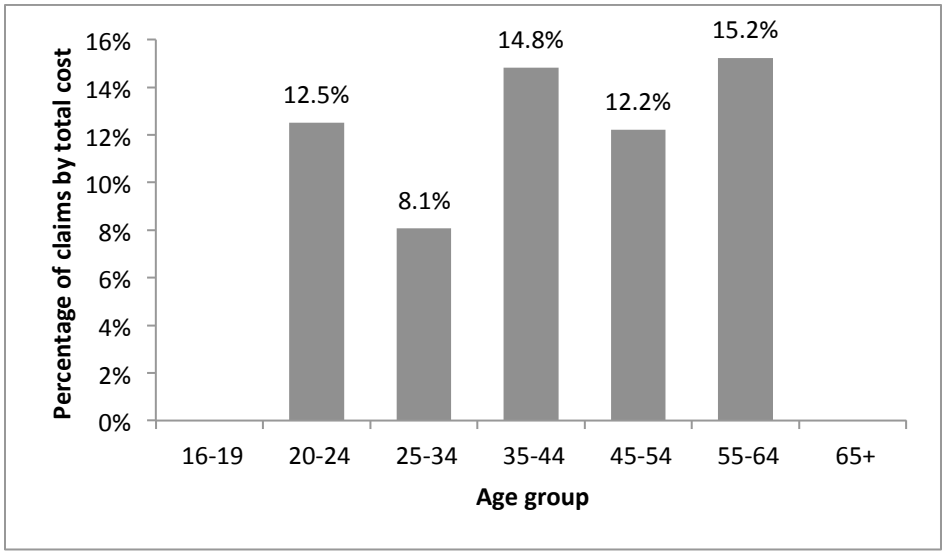

Figure 44. Percentage of falls, slips, and trips claims with total cost in the 10K-50K range by age.

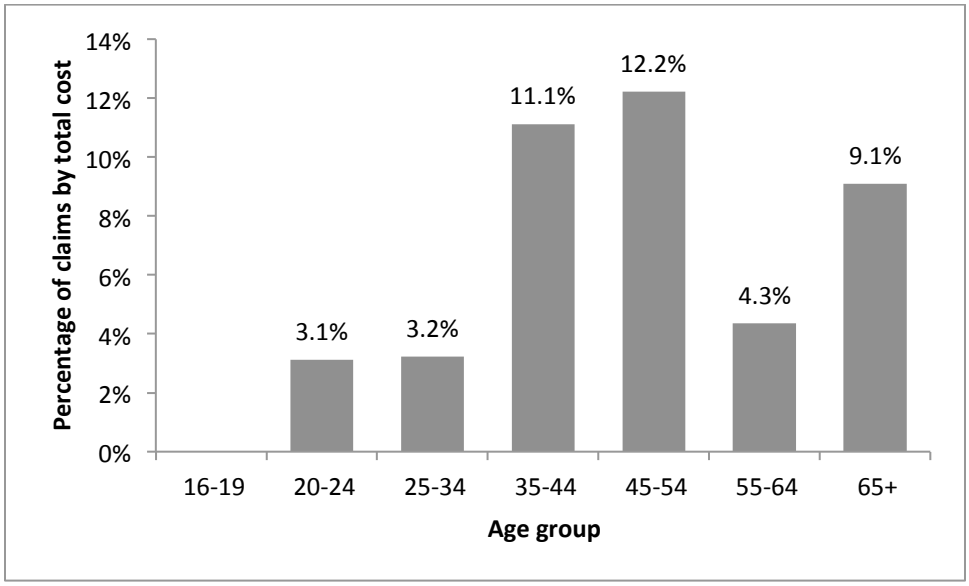

Figure 45. Percentage of falls, slips, and trips claims with total cost in the 50K-250K range by age.

CHAPTER 6: DISCUSSION AND CONCLUSION

6.1. Discussion and conclusions

The objective of this study was to analyze the type of injuries and illnesses that are occurring in the automobile and repair industries to determine common characteristics and the significant factors that led to the injuries along with estimated costs. Event or exposure was the first category researched. Contact with objects or equipment was the top category in regards to claims count, although it ranked third in total claims cost. There were far less claims in the overexertion and bodily reaction and falls, slips, trips classifications in comparison to contact with objects or equipment. However, these two events led total claims cost with each accounting for about 30% of total cost for the division. Also, lost time claims are usually the most costly of claims. Overexertion and bodily reaction and falls, slips, trips were the foremost events involving lost time. On the other hand, over half of the medical only claims were contact with objects or equipment.

In addition, other areas studied by event or exposure included source, part of body affected, and nature of injury. Due to the type of industry studied, I did not find it a surprise that parts and materials and vehicles were the leading sources of injury in both claims count and total cost. The parts of body most affected were hands, eyes, and backs which I think could be expected in this industry. Open wounds of the finger, sprains to the lumbar region, and open wounds of the hand were the most common categories in terms of claims count. The highest claims by total cost were thoracic or lumbar displacements and sprains to the rotator cuff.

Moreover, the contact with objects or equipment, overexertion and bodily reactions, and falls, slips, trips categories needed to be further analyzed because these three areas were the highest ranked in terms of frequency and severity of claims. The first group examined was contact with objects or equipment. Struck by object or equipment was the number one subcategory for this event. Approximately one third of all claims in this study were a result of the injured worker being struck by an object or equipment. Major sources of injury for this subcategory were scrap, waste, and debris and hand tools. Eyes were the body part most affected. As can be determined by looking at the leading injuries by claims count, several workers were injured by objects coming into contact with their eyes.

The next category researched was overexertion and bodily reaction. The top subcategory was overexertion involving outside sources. Vehicles and mobile equipment parts were the greatest source of injury in this subcategory. It is important to note that tires represented more than one quarter of the claims filed in the overexertion involving outside sources group. Lifting and lowering was the number one type of overexertion. The body parts most affected was the back and shoulder. Sprains to these areas were the most common type of claims in this classification.

The final event or exposure category analyzed was fall, slips, and trips. Over half of the claims in this classification were due to falls on the same level. However, falls to lower level led in total cost. Structures and surfaces was the top source of injury, which was expected because of the way the BLS classifies these types of claims. The body parts most affected was backs, knees, and ankles with the leading injuries by claims count

being sprains to these and similar areas. It is interesting to note that parking lots edged the floor for the top source of injury for falls on the same level. Another area of importance was secondary source. Almost half of the falls on same level claims were due to ice or snow. It can be concluded that the inclement weather in Ohio has a role on workers' compensation injuries, and it is an area in need of further study for this industry.

Furthermore, the rate of certain injuries in relationship to other injuries in that division was studied by age group. Those areas researched were contact with objects, overexertion and bodily reaction, and falls, slips, trips. The percentage of falls, slips, and trips increased with age. According to a study by Chau et al (2010) older workers were at a higher risk of falling than younger workers. This research involved not only falls but also slips and trips; however, the conclusion was the same. On the other hand, the rate of injury decreased with age in the contact with objects or equipment classification. One explanation for this could be experience. Perhaps the older workers were more knowledgeable of the risks of the job and were less likely to perform tasks without the use of safety equipment such as safety glasses or the required gloves. The final area analyzed was overexertion and bodily reaction. It was discovered that the rate of overexertions increased with age for the younger workers, peaking at the 35-44 age group, and then declining for the older age groups. A similar conclusion was surmised by Wuellner et al. (2011) in their study of lost-time work claims using BLS data.

Additionally, overexertion and bodily reactions and falls, slips, and trips were studied to see if there is a relationship between cost and age for these categories. The percentage of overexertion and bodily reaction by total cost decreased by age for the

lowest cost group (under $2,000) with the exception of the 55-64 age group. For the most part, the percentage of claims by total cost increased with age for all other cost groups. Also, the percentage of claims for falls, slips, and trips by total cost declined by age for the 16-19 to 45-54 age groups and then rose for the 55-64 and 65+ age groups in the under $2,000 cost category. No real correlation could be found between younger and older age groups in the other cost group categories. According to research by Restrepo et al (2006), claims cost rises with age. This was the case for the overexertion and bodily reaction category, but this theory did not hold true for falls, slips, and trips.

6.2. Recommendations for Improvement

As with any study, this research had limitations. First, although the data set was large, it was taken only for a certain year. Assumptions were made in the classification of the data and injury types. In addition, the data was summarized and there is always the possibility that the event could have been mis-recorded. The cost categories were arbitrarily made based on assumptions of different types of medical and insurance costs. Additionally, although we have age data, we cannot relate the length of tenure to the age of the employee. Comparisons with our data to previously published data with respect to injury types and age of employees were made, but we cannot determine the relationship between age, tenure, type of injury and cost.

6.3. Recommendations for Future Work

In conclusion, common characteristics and significant factors along with estimated costs have been determined for the automotive repair industry. The next step is to take the information we have learned about this industry and develop a prevention

program to preclude the recurrence of these types of injuries. Some areas of focus could be eye injury prevention, proper handling of tires, and the prevention of slips and falls due to slippery parking lots. Also, it would be very useful to interview employees who had injuries to determine how their experiences could be used to improve the intervention process. In addition, more analysis could be done on the relationship between age and injury. Other categories such as source of injury or illness and nature of injury could be broken down by age group, so we can get a better picture of what type of injuries are happening in the different age groups.

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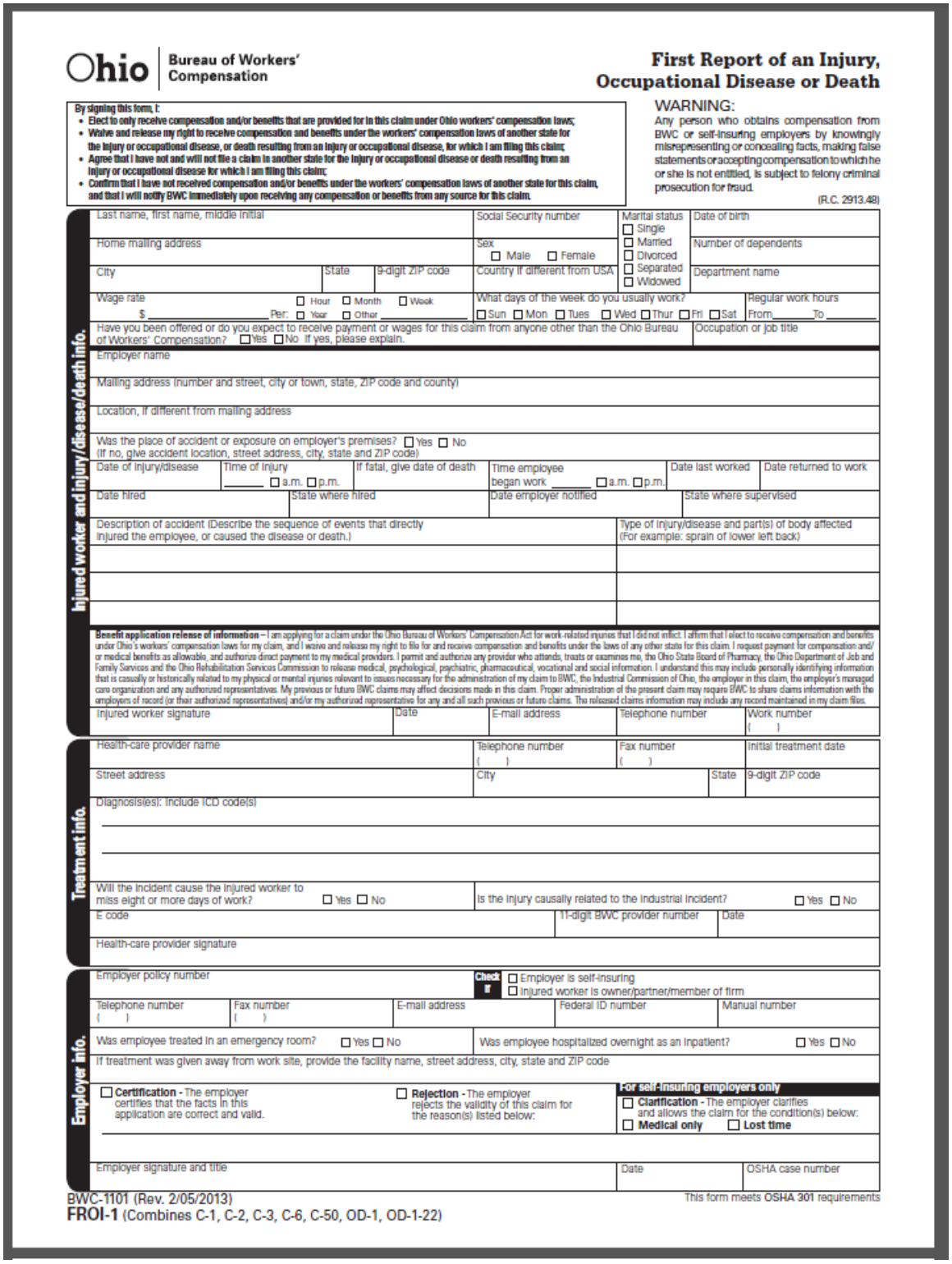
APPENDIX A: FIRST REPORT OF AN INJURY



Ohio | Bureau of Workers' Compensation

First Report of an Injury, Occupational Disease or Death

By signing this form, I:
- **Elect to only receive compensation and/or benefits that are provided for in this claim under Ohio workers' compensation laws;**
- **Waive and release my right to receive compensation and benefits under the workers' compensation laws of another state for the injury or occupational disease, or death resulting from an injury or occupational disease, for which I am filing this claim;**
- **Agree that I have not and will not file a claim in another state for the injury or occupational disease or death resulting from an injury or occupational disease for which I am filing this claim;**
- **Confirm that I have not received compensation and/or benefits under the workers' compensation laws of another state for this claim, and that I will notify BWC immediately upon receiving any compensation or benefits from any source for this claim.**

WARNING:
Any person who obtains compensation from BWC or self-insuring employers by knowingly misrepresenting or concealing facts, making false statements or accepting compensation to which he or she is not entitled, is subject to felony criminal prosecution for fraud.
(R.C. 2913.48)

Injured worker and injury/disease/death info.

Last name, first name, middle initial | Social Security number | Marital status ☐ Single ☐ Married ☐ Divorced ☐ Separated ☐ Widowed | Date of birth

Home mailing address | Sex ☐ Male ☐ Female | Number of dependents

City | State | 9-digit ZIP code | Country if different from USA | Department name

Wage rate $ _____ Per: ☐ Hour ☐ Month ☐ Week ☐ Year ☐ Other _____ | What days of the week do you usually work? ☐ Sun ☐ Mon ☐ Tues ☐ Wed ☐ Thur ☐ Fri ☐ Sat | Regular work hours From _____ To _____

Have you been offered or do you expect to receive payment or wages for this claim from anyone other than the Ohio Bureau of Workers' Compensation? ☐ Yes ☐ No If yes, please explain. | Occupation or job title

Employer name

Mailing address (number and street, city or town, state, ZIP code and county)

Location, if different from mailing address

Was the place of accident or exposure on employer's premises? ☐ Yes ☐ No
(If no, give accident location, street address, city, state and ZIP code)

Date of injury/disease | Time of injury _____ ☐ a.m. ☐ p.m. | If fatal, give date of death | Time employee began work _____ ☐ a.m. ☐ p.m. | Date last worked | Date returned to work

Date hired | State where hired | Date employer notified | State where supervised

Description of accident (Describe the sequence of events that directly injured the employee, or caused the disease or death.) | Type of injury/disease and part(s) of body affected (For example: sprain of lower left back)

Benefit application release of information – I am applying for a claim under the Ohio Bureau of Workers' Compensation Act for work-related injuries that I did not inflict. I affirm that I elect to receive compensation and benefits under Ohio's workers' compensation laws for my claim, and I waive and release my right to file for and receive compensation and benefits under the laws of any other state for this claim. I request payment for compensation and/or medical benefits as allowable, and authorize direct payment to my medical providers. I permit and authorize any provider who attends, treats or examines me, the Ohio State Board of Pharmacy, the Ohio Department of Job and Family Services and the Ohio Rehabilitation Services Commission to release medical, psychological, psychiatric, pharmaceutical, vocational and social information. I understand this may include personally identifying information that is casually or historically related to my physical or mental injuries relevant to issues necessary for the administration of my claim to BWC, the Industrial Commission of Ohio, the employer in this claim, the employer's managed care organization and any authorized representatives. My previous or future BWC claims may affect decisions made in this claim. Proper administration of the present claim may require BWC to share claims information with the employers of record (or their authorized representatives) and/or my authorized representative for any and all such previous or future claims. The released claims information may include any record maintained in my claim files.

Injured worker signature | Date | E-mail address | Telephone number | Work number ( )

Treatment info.

Health-care provider name | Telephone number ( ) | Fax number ( ) | Initial treatment date

Street address | City | State | 9-digit ZIP code

Diagnosis(es): Include ICD code(s)

Will the incident cause the injured worker to miss eight or more days of work? ☐ Yes ☐ No | Is the injury causally related to the industrial incident? ☐ Yes ☐ No

E code | 11-digit BWC provider number | Date

Health-care provider signature

Employer info.

Employer policy number | Check if ☐ Employer is self-insuring ☐ Injured worker is owner/partner/member of firm

Telephone number ( ) | Fax number ( ) | E-mail address | Federal ID number | Manual number

Was employee treated in an emergency room? ☐ Yes ☐ No | Was employee hospitalized overnight as an inpatient? ☐ Yes ☐ No

If treatment was given away from work site, provide the facility name, street address, city, state and ZIP code

☐ **Certification** - The employer certifies that the facts in this application are correct and valid.

☐ **Rejection** - The employer rejects the validity of this claim for the reason(s) listed below:

For self-insuring employers only
☐ **Clarification** - The employer clarifies and allows the claim for the condition(s) below:
☐ **Medical only** ☐ **Lost time**

Employer signature and title | Date | OSHA case number

BWC-1101 (Rev. 2/05/2013)
FROI-1 (Combines C-1, C-2, C-3, C-6, C-50, OD-1, OD-1-22)

This form meets OSHA 301 requirements

APPENDIX B: EVENT OR EXPOSURE (SUBCATEGORY) BY TOTAL COST

Event or exposure (by subcategory)	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Overexertion involving outside sources	1,625,222	921,315	1,380,572	3,927,109
Falls to lower level	656,117	312,992	1,029,969	1,999,078
Falls on same level	799,251	389,289	487,172	1,675,713
Struck by object or equipment	961,331	226,405	261,015	1,448,751
Fires	1,098,027	19,535	0	1,117,562
Roadway incidents	360,094	187,509	485,337	1,032,939
Slips or trips without fall	231,204	194,912	294,687	720,804
Intentional injury by person	12,930	74,945	587,325	675,199
Caught in or compressed by equipment or objects	260,804	101,039	127,867	489,710
Struck against object or equipment	369,952	73,338	0	443,290
Pedestrian vehicular incidents	176,639	59,035	144,199	379,873
Other exertions and bodily reactions	180,599	89,269	96,811	366,679
Explosions	95,402	19,560	242	115,204
Non-classifiable	53,986	24,314	31,973	110,274
Exposure to other harmful substances	37,967	20,559	9,278	67,804
Non-roadway incidents	47,576	11,848	5,208	64,633
Multiple type of overexertions and bodily reactions	27,038	24,928	3,794	55,760
Exposure to temperature extremes	41,165	6,901	0	48,066
Jumps to lower level	29,914	9,023	0	38,937
Exposure to electricity	19,641	0	6,976	26,617
Bodily conditions, n.e.c.	4,966	0	0	4,966
Animal and insect related incidents	4,359	0	0	4,359
Exposure to radiation or noise	2,218	0	0	2,218
Total	$7,096,402	$2,766,717	$4,952,425	$14,815,543

APPENDIX C: LEADING SOURCES OF INJURY OR ILLNESS (SUBCATEGORY) BY TOTAL COST

Source of injury by subcategory	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Vehicle and mobile equipment parts	$1,317,106	$705,217	$1,004,216	$3,026,539
Highway vehicles, motorized	$1,382,839	$547,318	$1,081,281	$3,011,438
Floors, walkways, ground surfaces	$871,391	$410,644	$502,402	$1,784,437
Heating and cooking machinery and appliances	$1,093,740	$18,083	$0	$1,111,823
Bodily motion or position of the injured, ill worker	$411,709	$284,181	$391,498	$1,087,389
Hand tools- non-powered	$406,158	$208,687	$198,279	$813,124
Person other than injured/ill worker	$12,930	$74,945	$587,325	$675,199
Off-road and industrial vehicles-powered	$174,031	$52,822	$408,790	$635,642
Ladders	$204,627	$118,577	$186,390	$509,594
Material and personnel handling machinery	$162,110	$82,181	$230,755	$475,046
Other machinery	$145,624	$56,451	$174,726	$376,800
Non-classifiable	$111,893	$56,559	$37,311	$205,762
Other structural elements	$98,805	$6,392	$76,973	$182,170
Scrap, waste, debris	$153,761	$9,493	$7,578	$170,831
Containers	$115,830	$27,839	$3,321	$146,990
Hand tools- powered	$90,098	$24,745	$24,044	$138,888
Other sources, n.e.c.	$39,501	$28,049	$3,794	$71,343
Machine, tool, and electric parts	$47,487	$6,827	$12,718	$67,032
Furniture and fixtures	$34,825	$9,968	$596	$45,388
Other tools, instruments, and equipment	$37,631	$500	$4,061	$42,192

APPENDIX D: PART OF BODY AFFECTED (SUBCATEGORY) BY TOTAL COST

Part of body affected (by subcategory)	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Back	1,169,998	800,037	1,687,103	3,657,138
Shoulder	1,287,495	645,550	1,086,033	3,019,078
Hand	1,939,203	254,628	26,046	2,219,876
Knee	493,554	301,318	346,538	1,141,410
Cranial region	201,422	98,863	534,456	834,741
Leg, excluding knee	385,203	74,618	358,349	818,171
Chest	109,469	106,421	587,325	803,214
Wrist	238,180	95,128	116,578	449,886
Arm	287,248	131,120	18,438	436,806
Ankle	163,225	55,705	107,740	326,669
Pelvic region	195,172	52,039	31,051	278,262
Foot	125,687	55,599	34,125	215,411
Abdomen	115,710	44,713	0	160,423
Face, excluding eye	127,805	8,352	16,347	152,504
Eye	142,469	5,553	508	148,531
Neck	57,856	8,855	1,110	67,821
Body systems	13,532	10,000	678	24,210
Multiple upper extremities	14,597	8,780	0	23,377
Multiple body parts	8,128	2,987	0	11,116
Ear	7,790	1,452	0	9,242
Head, unspecified	8,868	0	0	8,868
Non-classifiable	1,039	5,000	0	6,039
Head and neck	1,782	0	0	1,782
Whole body	968	0	0	968
Total	$7,096,402	$2,766,717	$4,952,425	$14,815,543

APPENDIX E: CONTACT WITH OBJECTS OR EQUIPMENT- SOURCE OF INJURY OR ILLNESS BY TOTAL COST

Source of injury or illness	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Vehicles	741,168	239,345	308,820	1,289,332
Parts and materials	301,619	88,724	12,413	402,756
Tools, instruments, and equipment	232,477	29,815	11,081	273,373
Other sources	165,563	12,614	7,578	185,755
Machinery	99,421	28,246	48,395	176,062
Containers, furniture, and fixtures	32,465	2,038	596	35,099
Structures and surfaces	14,956	0	0	14,956
Non-classifiable	3,629	0	0	3,629
Persons, plants, animals, and minerals	788	0	0	788
Total	$1,592,087	$400,782	$388,882	$2,381,751

APPENDIX F: CONTACT WITH OBJECTS OR EQUIPMENT- PART OF BODY AFFECTED BY TOTAL COST

Part of body affected	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Hand	720,353	187,501	13,235	921,089
Leg, excluding knee	177,605	42,144	132,653	352,402
Knee	68,535	46,624	115,897	231,056
Shoulder	64,006	12,961	96,025	172,991
Eye	119,593	5,553	508	125,655
Chest	73,551	24,910	0	98,460
Face, excluding eye	81,738	1,044	7,070	89,852
Foot	53,201	22,789	7,045	83,036
Cranial region	68,923	95	11,081	80,099
Arm	64,386	12,168	0	76,554
Wrist	38,726	16,075	5,367	60,169
Ankle	16,534	18,819	0	35,353
Neck	15,297	4,008	0	19,305
Abdomen	15,062	2,237	0	17,299
Multiple upper extremities	3,687	3,855	0	7,542
Head, unspecified	6,267	0	0	6,267
Ear	2,979	0	0	2,979
Back	1,643	0	0	1,643
Total	$1,592,087	$400,782	$388,882	$2,381,751

APPENDIX G: CONTACT WITH OBJECTS OR EQUIPMENT – LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
823.02	FX UP TIBIA W FIBULA-CL	1	$ 309,188.12
337.21	RSD, UPPER LIMB	2	$ 222,432.03
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 192,820.13
883	OPEN WOUND OF FINGER	165	$ 102,888.40
927.3	CRUSHING INJURY FINGER	18	$ 96,067.86
807.01	FRACTURE ONE RIB-CLOSED	1	$ 87,810.05
726.1	ROTATOR CUFF SYNDR ET AL	1	$ 73,730.18
882	OPEN WOUND OF HAND	99	$ 72,211.99
840.4	SPRAIN ROTATOR CUFF	1	$ 67,710.55
930	FOREIGN BODY EXTERN EYE	82	$ 56,787.25
816.12	FX DISTAL PHAL, HAND-OPN	10	$ 54,725.61
816.11	FX MID/PRX PHAL, HAND-OP	4	$ 54,441.42
736.1	MALLET FINGER	1	$ 43,700.58
886	TRAUM AMPUTATION FINGER	4	$ 33,659.31
883.2	OPEN WND FINGER W TENDON	13	$ 31,678.20

APPENDIX H: CONTACT WITH OBJECTS OR EQUIPMENT- LEADING INJURIES BY AVERAGE COST

ICD code	ICD description	Count	Average claim cost
823.02	FX UP TIBIA W FIBULA-CL	1	$ 309,188.12
337.21	RSD, UPPER LIMB	2	$ 111,216.02
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 96,410.07
807.01	FRACTURE ONE RIB-CLOSED	1	$ 87,810.05
726.1	ROTATOR CUFF SYNDR ET AL	1	$ 73,730.18
840.4	SPRAIN ROTATOR CUFF	1	$ 67,710.55
736.1	MALLET FINGER	1	$ 43,700.58
801.01	CL SKUL BASE FX W/O COMA	1	$ 28,896.10
727.65	RUPTURE QUADRICEP TENDON	1	$ 28,267.09
845.09	SPRAIN OF ANKLE NEC	1	$ 24,699.20
825.35	FX METATARSAL-OPEN	1	$ 20,880.84
840.3	SPRAIN INFRASPINATUS	1	$ 16,814.80
825.23	FX CUBOID-CLOSED	1	$ 16,285.18
955.2	INJURY ULNAR NERVE	1	$ 16,282.52
729.6	OLD FB IN SOFT TISSUE	1	$ 15,675.18

APPENDIX I: CONTACT WITH OBJECTS OR EQUIPMENT- LEADING INJURIES BY MEDICAL COST

ICD code	ICD description	Count	Medical cost
337.21	RSD, UPPER LIMB	2	$ 175,263.48
823.02	FX UP TIBIA W FIBULA-CL	1	$ 134,390.79
883	OPEN WOUND OF FINGER	165	$ 102,064.15
882	OPEN WOUND OF HAND	99	$ 68,035.99
807.01	FRACTURE ONE RIB-CLOSED	1	$ 62,900.29
927.3	CRUSHING INJURY FINGER	18	$ 59,523.79
930	FOREIGN BODY EXTERN EYE	82	$ 55,831.36
816.11	FX MID/PRX PHAL, HAND-OP	4	$ 54,441.42
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 40,972.71
816.12	FX DISTAL PHAL, HAND-OPN	10	$ 34,488.96
920	CONTUSION FACE/SCALP/NCK	36	$ 29,489.46
883.2	OPEN WND FINGER W TENDON	13	$ 28,962.35
727.65	RUPTURE QUADRICEP TENDON	1	$ 28,267.09
918.1	CORNEAL ABRASION	85	$ 27,585.58
873	OTHER OPEN WOUND OF HEAD	36	$ 21,174.03

APPENDIX J: CONTACT WITH OBJECTS OR EQUIPMENT- LEADING INJURIES BY INDEMNITY COST

ICD code	ICD description	Count	Indemnity cost
823.02	FX UP TIBIA W FIBULA-CL	1	$ 42,144.02
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 36,619.85
927.3	CRUSHING INJURY FINGER	18	$ 36,544.07
337.21	RSD, UPPER LIMB	2	$ 34,529.19
736.1	MALLET FINGER	1	$ 29,468.44
807.01	FRACTURE ONE RIB-CLOSED	1	$ 24,909.76
816.12	FX DISTAL PHAL, HAND-OPN	10	$ 20,236.65
886	TRAUM AMPUTATION FINGER	4	$ 19,351.29
825.35	FX METATARSAL-OPEN	1	$ 15,372.80
816.02	FX DIST PHALANX, HAND-CL	9	$ 13,087.29
845.09	SPRAIN OF ANKLE NEC	1	$ 11,727.76
883.1	OPEN WOUND FINGER-COMPL	13	$ 9,553.46
726.1	ROTATOR CUFF SYNDR ET AL	1	$ 8,834.60
727.04	RADIAL STYLOID TENOSYNOV	2	$ 8,003.37
824	ANKLE FRACTURE	1	$ 7,091.43

APPENDIX K: STRUCK BY OBJECT OR EQUIPMENT- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
823.02	FX UP TIBIA W FIBULA-CL	1	$ 309,188.12
927.3	CRUSHING INJURY FINGER	9	$ 89,344.59
807.01	FRACTURE ONE RIB-CLOSED	1	$ 87,810.05
726.1	ROTATOR CUFF SYNDR ET AL	1	$ 73,730.18
840.4	SPRAIN ROTATOR CUFF	1	$ 67,710.55
930	FOREIGN BODY EXTERN EYE	81	$ 56,221.29
736.1	MALLET FINGER	1	$ 43,700.58
883	OPEN WOUND OF FINGER	79	$ 39,424.89
882	OPEN WOUND OF HAND	46	$ 34,206.51
801.01	CL SKUL BASE FX W/O COMA	1	$ 28,896.10
727.65	RUPTURE QUADRICEP TENDON	1	$ 28,267.09
918.1	CORNEAL ABRASION	84	$ 27,378.36
920	CONTUSION FACE/SCALP/NCK	26	$ 24,130.93
816.11	FX MID/PRX PHAL, HAND-OP	2	$ 22,570.96
924.2	CONTUSION ANKLE & FOOT	11	$ 21,851.38

APPENDIX L: STRUCK AGAINST OBJECT OR EQUIPMENT- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
337.21	RSD, UPPER LIMB	1	$ 161,742.66
883	OPEN WOUND OF FINGER	70	$ 53,703.69
882	OPEN WOUND OF HAND	41	$ 26,887.44
883.2	OPEN WND FINGER W TENDON	6	$ 21,427.78
681	CELLULITIS, FINGER/TOE	3	$ 17,597.95
816.02	FX DIST PHALANX, HAND-CL	2	$ 16,208.64
726.33	OLECRANON BURSITIS	2	$ 15,292.23
873	OTHER OPEN WOUND OF HEAD	23	$ 14,329.05
850	CONCUSSION	6	$ 12,159.88
923.2	CONTUSION OF WRIST/HAND	9	$ 9,497.99
840.9	SPRAIN SHOULDER/ARM NOS	1	$ 8,887.58
682.3	CELLULITIS AND ABSCESS ARM	3	$ 8,155.29
816	FRACTURE PHALANGES, HAND	1	$ 7,620.57
881	OPEN WOUND OF LOWER ARM	9	$ 6,832.15
883.1	OPEN WOUND FINGER-COMPL	7	$ 5,946.50

APPENDIX M: CAUGHT IN OR COMPRESSED BY EQUIPMENT OR OBJECTS-LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
844.2	SPRAIN CRUCIATE LIG KNEE	1	$ 189,520.51
337.21	RSD, UPPER LIMB	1	$ 60,689.37
816.12	FX DISTAL PHAL, HAND-OPN	6	$ 51,219.06
816.11	FX MID/PRX PHAL, HAND-OP	2	$ 31,870.46
845.09	SPRAIN OF ANKLE NEC	1	$ 24,699.20
883.1	OPEN WOUND FINGER-COMPL	2	$ 20,226.74
886	TRAUM AMPUTATION FINGER	2	$ 13,230.26
836.1	TEAR LAT MENISC KNEE-CUR	1	$ 12,475.69
882	OPEN WOUND OF HAND	12	$ 11,118.04
824	ANKLE FRACTURE	1	$ 10,482.33
883	OPEN WOUND OF FINGER	16	$ 9,759.82
816.02	FX DIST PHALANX, HAND-CL	2	$ 7,509.03
927.3	CRUSHING INJURY FINGER	9	$ 6,723.27
927.2	CRUSHING INJ WRIST/HAND	3	$ 6,682.24
816	FRACTURE PHALANGES, HAND	7	$ 6,570.81

APPENDIX N: OVEREXERTION AND BODILY REACTION- SOURCE OF INJURY OR ILLNESS BY TOTAL COST

Source of injury or illness	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Parts and materials	1,029,858	604,882	997,982	2,632,722
Tools, instruments, and equipment	332,485	231,263	220,641	784,389
Persons, plants, animals, and minerals	185,564	89,269	96,811	371,645
Machinery	132,467	45,181	126,331	303,979
Containers, furniture, and fixtures	83,627	35,769	3,321	122,717
Non-classifiable	46,287	24,314	31,973	102,575
Vehicles	39,177	4,220	32,298	75,695
Other sources	29,076	24,928	3,794	57,798
Structures and surfaces	4,260	0	0	4,260
Total	$1,882,802	$1,059,827	$1,513,150	$4,455,779

APPENDIX O: OVEREXERTION AND BODILY REACTION- PART OF BODY AFFECTED BY TOTAL COST

Part of body affected	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Back	576,929	403,878	815,614	1,796,421
Shoulder	635,651	354,983	559,855	1,550,489
Wrist	144,554	56,807	76,391	277,752
Arm	141,316	115,180	12,141	268,637
Knee	108,587	34,519	27,896	171,001
Abdomen	82,734	35,774	0	118,508
Pelvic region	93,292	22,087	361	115,740
Hand	29,106	25,413	12,811	67,329
Foot	17,377	4,783	8,081	30,242
Neck	19,077	4,847	0	23,924
Ankle	16,639	1,555	0	18,194
Chest	8,298	0	0	8,298
Cranial region	4,966	0	0	4,966
Leg, excluding knee	3,594	0	0	3,594
Face, excluding eye	683	0	0	683
Total	$1,882,802	$1,059,827	$1,513,150	$4,455,779

APPENDIX P: OVEREXERTION AND BODILY REACTION- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
722.1	THORAC/LUMB DISC DISPLAC	16	$ 1,142,949.69
840.4	SPRAIN ROTATOR CUFF	18	$ 991,970.39
726.1	ROTATOR CUFF SYNDR ET AL	8	$ 180,262.70
722.52	LUMB/LUMBOSAC DISC DEGEN	3	$ 174,081.13
842	SPRAIN WRIST & HAND	15	$ 170,013.50
847.2	SPRAIN LUMBAR REGION	92	$ 155,046.03
840.9	SPRAIN SHOULDER/ARM NOS	41	$ 140,860.29
805.4	FX LUMBAR VERTEBRA-CLOSE	1	$ 140,560.23
550.9	INGUINAL HERNIA NOS	19	$ 138,664.25
726.2	SHOULDER REGION DIS NEC	2	$ 120,233.88
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 104,284.41
722	INTERVERTEBRAL DISC DIS	3	$ 98,660.99
727.05	TENOSYNOV HAND/WRIST NEC	8	$ 87,431.26
846	SPRAIN SACROILIAC REGION	39	$ 74,510.05
836	DISLOCATION OF KNEE	5	$ 62,955.47

APPENDIX Q: OVEREXERTION AND BODILY REACTION- LEADING INJURIES BY AVERAGE COST

ICD code	ICD description	Count	Average claim cost
805.4	FX LUMBAR VERTEBRA-CLOSE	1	$ 140,560.23
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 104,284.41
722.1	THORAC/LUMB DISC DISPLAC	16	$ 71,434.36
726.2	SHOULDER REGION DIS NEC	2	$ 60,116.94
722.52	LUMB/LUMBOSAC DISC DEGEN	3	$ 58,027.04
840.4	SPRAIN ROTATOR CUFF	18	$ 55,109.47
840	SPRAIN SHOULDER & ARM	1	$ 42,880.82
726.19	ROTATOR CUFF DIS NEC	1	$ 34,461.63
722	INTERVERTEBRAL DISC DIS	3	$ 32,887.00
726.73	CALCANEAL SPUR	1	$ 29,378.45
726.1	ROTATOR CUFF SYNDR ET AL	8	$ 22,532.84
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 19,180.29
727.41	GANGLION OF JOINT	1	$ 17,293.00
727.62	BICEPS TENDON RUPTURE	2	$ 15,655.60
841.8	SPRAIN ELBOW/FOREARM NEC	3	$ 14,042.97

APPENDIX R: OVEREXERTION AND BODILY REACTION- LEADING INJURIES BY MEDICAL COST

ICD code	ICD description	Count	Medical cost
840.4	SPRAIN ROTATOR CUFF	18	$ 334,285.06
722.1	THORAC/LUMB DISC DISPLAC	16	$ 301,858.75
847.2	SPRAIN LUMBAR REGION	92	$ 122,732.02
840.9	SPRAIN SHOULDER/ARM NOS	41	$ 107,662.37
550.9	INGUINAL HERNIA NOS	19	$ 98,135.11
842	SPRAIN WRIST & HAND	15	$ 93,102.70
726.1	ROTATOR CUFF SYNDR ET AL	8	$ 89,613.47
836	DISLOCATION OF KNEE	5	$ 51,817.59
846	SPRAIN SACROILIAC REGION	39	$ 51,396.38
840.8	SPRAIN SHOULDER/ARM NEC	9	$ 40,798.78
726.2	SHOULDER REGION DIS NEC	2	$ 36,834.57
722	INTERVERTEBRAL DISC DIS	3	$ 36,534.33
722.52	LUMB/LUMBOSAC DISC DEGEN	3	$ 33,446.63
553.1	UMBILICAL HERNIA	4	$ 31,159.01
727.05	TENOSYNOV HAND/WRIST NEC	8	$ 29,809.29

APPENDIX S: OVEREXERTION AND BODILY REACTION- LEADING INJURIES BY INDEMNITY COST

ICD code	ICD description	Count	Indemnity cost
722.1	THORAC/LUMB DISC DISPLAC	16	$ 249,155.10
840.4	SPRAIN ROTATOR CUFF	18	$ 231,673.87
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 75,850.02
805.4	FX LUMBAR VERTEBRA-CLOSE	1	$ 51,406.77
722.52	LUMB/LUMBOSAC DISC DEGEN	3	$ 44,401.15
550.9	INGUINAL HERNIA NOS	19	$ 40,529.14
727.05	TENOSYNOV HAND/WRIST NEC	8	$ 38,311.73
726.1	ROTATOR CUFF SYNDR ET AL	8	$ 33,530.96
840.9	SPRAIN SHOULDER/ARM NOS	41	$ 32,575.34
842	SPRAIN WRIST & HAND	15	$ 32,493.10
847.2	SPRAIN LUMBAR REGION	92	$ 32,314.01
726.2	SHOULDER REGION DIS NEC	2	$ 30,732.21
846	SPRAIN SACROILIAC REGION	39	$ 15,801.11
841.8	SPRAIN ELBOW/FOREARM NEC	3	$ 15,457.82
844.9	SPRAIN OF KNEE & LEG NOS	18	$ 14,287.60

APPENDIX T: OVEREXERTION INVOLVING OUTSIDE SOURCES- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
722.1	THORAC/LUMB DISC DISPLAC	16	$ 1,142,949.69
840.4	SPRAIN ROTATOR CUFF	16	$ 973,294.07
726.1	ROTATOR CUFF SYNDR ET AL	8	$ 180,262.70
842	SPRAIN WRIST & HAND	14	$ 168,863.76
805.4	FX LUMBAR VERTEBRA-CLOSE	1	$ 140,560.23
550.9	INGUINAL HERNIA NOS	19	$ 138,664.25
840.9	SPRAIN SHOULDER/ARM NOS	37	$ 136,610.09
847.2	SPRAIN LUMBAR REGION	70	$ 130,460.51
726.2	SHOULDER REGION DIS NEC	2	$ 120,233.88
831.01	ANT DISLOC HUMERUS-CLOSE	1	$ 104,284.41
722	INTERVERTEBRAL DISC DIS	3	$ 98,660.99
846	SPRAIN SACROILIAC REGION	27	$ 62,663.85
840.8	SPRAIN SHOULDER/ARM NEC	9	$ 54,279.27
722.52	LUMB/LUMBOSAC DISC DEGEN	2	$ 48,019.42
840	SPRAIN SHOULDER & ARM	1	$ 42,880.82

APPENDIX U: OTHER EXERTIONS AND BODILY REACTIONS- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
722.52	LUMB/LUMBOSAC DISC DEGEN	1	$ 126,061.71
836	DISLOCATION OF KNEE	4	$ 53,183.62
844.2	SPRAIN CRUCIATE LIG KNEE	2	$ 38,360.57
726.73	CALCANEAL SPUR	1	$ 29,378.45
844.9	SPRAIN OF KNEE & LEG NOS	12	$ 24,325.76
847.2	SPRAIN LUMBAR REGION	17	$ 18,196.14
846	SPRAIN SACROILIAC REGION	12	$ 11,846.20
836.1	TEAR LAT MENISC KNEE-CUR	1	$ 11,443.69
553.1	UMBILICAL HERNIA	1	$ 8,968.16
726.6	ENTHESOPATHY OF KNEE	1	$ 5,850.21
845	SPRAIN OF ANKLE & FOOT	5	$ 4,320.02
840.9	SPRAIN SHOULDER/ARM NOS	4	$ 4,250.20
824.2	FX LATERAL MALLEOLUS-CL	1	$ 3,854.09
723.4	BRACHIAL NEURITIS NOS	1	$ 3,308.39
727.03	TRIGGER FINGER	1	$ 3,242.27
717.7	CHONDROMALACIA PATELLAE	1	$ 2,737.92

APPENDIX V: FALLS, SLIPS TRIPS- LEADING INJURIES BY TOTAL COST

Source of injury or illness	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Structures and surfaces	974,730	426,501	584,378	1,985,609
Vehicles	197,605	98,184	515,618	811,407
Persons, plants, animals, and minerals	226,145	194,912	294,687	715,744
Tools, instruments, and equipment	210,842	119,077	186,390	516,309
Machinery	97,309	67,541	230,755	395,605
Containers, furniture, fixtures	8,334	0	0	8,334
Non-classifiable	7,436	0	0	7,436
Total	$1,722,402	$906,216	$1,811,828	$4,440,446

APPENDIX W: FALLS, SLIPS, TRIPS- PART OF BODY AFFECTED BY TOTAL COST

Part of body affected	Total medical cost	Total indemnity cost	Total reserve cost	Total cost
Back	480,220	259,755	629,263	1,369,239
Shoulder	471,495	228,347	343,829	1,043,672
Cranial region	117,934	98,268	523,375	739,578
Knee	233,769	193,865	123,113	550,747
Ankle	114,537	32,628	107,740	254,905
Pelvic region	88,533	21,599	30,690	140,823
Wrist	42,981	20,421	34,819	98,221
Foot	42,208	22,690	18,998	83,896
Arm	35,701	3,773	-	39,474
Hand	28,545	1,678	-	30,223
Chest	19,166	6,566	-	25,732
Abdomen	13,997	6,702	-	20,699
Multiple upper extremities	9,940	4,925	-	14,864
Neck	10,236	-	-	10,236
Non-classifiable	371	5,000	-	5,371
Leg, excluding knee	4,724	-	-	4,724
Face, excluding eye	4,615	-	-	4,615
Head and neck	1,782	-	-	1,782
Head, unspecified	984	-	-	984
Eye	662	-	-	662
Total	$1,722,402	$906,216	$1,811,828	$4,440,446

APPENDIX X: FALLS, SLIPS, TRIPS- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
840.4	SPRAIN ROTATOR CUFF	11	$ 747,249.89
722.1	THORAC/LUMB DISC DISPLAC	8	$ 709,547.85
801.26	CL SKUL BASE FX-COMA NOS	1	$ 425,300.10
844.2	SPRAIN CRUCIATE LIG KNEE	7	$ 227,633.87
801.09	CL SKULL BASE FX-CONCUSS	1	$ 221,161.18
836	DISLOCATION OF KNEE	5	$ 216,852.93
722	INTERVERTEBRAL DISC DIS	1	$ 203,952.97
805.6	FX SACRUM/COCCYX-CLOSED	1	$ 164,297.00
805.2	FX DORSAL VERTEBRA-CLOSE	2	$ 157,487.27
824.7	FX TRIMALLEOLAR-OPEN	1	$ 154,162.37
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 134,182.79
847.2	SPRAIN LUMBAR REGION	31	$ 94,456.02
844.9	SPRAIN OF KNEE & LEG NOS	15	$ 75,809.64
840.6	SPRAIN SUPRASPINATUS	3	$ 67,235.51
843.9	SPRAIN HIP & THIGH NOS	1	$ 64,750.97

APPENDIX Y: FALLS, SLIPS, TRIPS- LEADING INJURIES BY AVERAGE COST

ICD code	ICD description	Count	Average claim cost
801.26	CL SKUL BASE FX-COMA NOS	1	$ 425,300.10
801.09	CL SKULL BASE FX-CONCUSS	1	$ 221,161.18
722	INTERVERTEBRAL DISC DIS	1	$ 203,952.97
805.6	FX SACRUM/COCCYX-CLOSED	1	$ 164,297.00
824.7	FX TRIMALLEOLAR-OPEN	1	$ 154,162.37
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 134,182.79
722.1	THORAC/LUMB DISC DISPLAC	8	$ 88,693.48
805.2	FX DORSAL VERTEBRA-CLOSE	2	$ 78,743.64
840.4	SPRAIN ROTATOR CUFF	11	$ 67,931.81
850.9	SPRAIN HIP & THIGH NOS	1	$ 64,750.97
825	CONCUSSION NOS	1	$ 53,796.90
836	FX OF TARSAL/METATARSAL	1	$ 46,025.20
843.9	DISLOCATION OF KNEE	5	$ 43,370.59
844.2	SPRAIN CRUCIATE LIG KNEE	7	$ 32,519.12
820.21	INTERTROCHANTERIC FX-CL	2	$ 30,293.35

APPENDIX Z: FALLS, SLIPS, TRIPS- LEADING INJURIES BY MEDICAL COST

ICD code	ICD description	Count	Medical cost
840.4	SPRAIN ROTATOR CUFF	11	$ 313,715.43
722.1	THORAC/LUMB DISC DISPLAC	8	$ 240,309.26
844.2	SPRAIN CRUCIATE LIG KNEE	7	$ 134,000.51
805.6	FX SACRUM/COCCYX-CLOSED	1	$ 80,932.21
847.2	SPRAIN LUMBAR REGION	31	$ 70,802.16
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 54,184.13
820.21	INTERTROCHANTERIC FX-CL	2	$ 53,310.91
836	DISLOCATION OF KNEE	5	$ 47,354.78
824.7	FX TRIMALLEOLAR-OPEN	1	$ 46,288.50
801.26	CL SKUL BASE FX-COMA NOS	1	$ 42,969.89
837	DISLOCATION OF ANKLE	2	$ 35,198.67
844.9	SPRAIN OF KNEE & LEG NOS	15	$ 32,927.05
801.09	CL SKULL BASE FX-CONCUSS	1	$ 31,934.39
722	INTERVERTEBRAL DISC DIS	1	$ 30,028.25
840.8	SPRAIN SHOULDER/ARM NEC	2	$ 25,954.16

APPENDIX AA: FALLS, SLIPS, TRIPS- LEADING INJURIES BY INDEMNITY COST

ICD code	ICD description	Count	Indemnity cost
840.4	SPRAIN ROTATOR CUFF	11	$ 173,054.09
836	DISLOCATION OF KNEE	5	$ 129,671.53
722.1	THORAC/LUMB DISC DISPLAC	8	$ 125,586.92
805.2	FX DORSAL VERTEBRA-CLOSE	2	$ 60,588.27
801.09	CL SKULL BASE FX-CONCUSS	1	$ 52,474.10
722	INTERVERTEBRAL DISC DIS	1	$ 45,085.21
844.2	SPRAIN CRUCIATE LIG KNEE	7	$ 33,267.83
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 29,124.26
801.26	CL SKUL BASE FX-COMA NOS	1	$ 21,515.41
844.9	SPRAIN OF KNEE & LEG NOS	15	$ 19,961.61
840.6	SPRAIN SUPRASPINATUS	3	$ 18,833.53
847.2	SPRAIN LUMBAR REGION	31	$ 17,695.60
850.9	CONCUSSION NOS	1	$ 17,015.59
843.9	SPRAIN HIP & THIGH NOS	1	$ 14,323.64
825	FX OF TARSAL/METATARSAL	1	$ 14,292.25

APPENDIX BB: FALLS ON SAME LEVEL- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
840.4	SPRAIN ROTATOR CUFF	8	$ 554,425.04
722.1	THORAC/LUMB DISC DISPLAC	3	$ 229,975.59
805.2	FX DORSAL VERTEBRA-CLOSE	1	$ 147,257.47
955.7	INJ NERVE SHLDR/ARM NEC	1	$ 134,182.79
820.21	INTERTROCHANTERIC FX-CL	2	$ 60,586.70
837	DISLOCATION OF ANKLE	2	$ 58,378.04
850.9	CONCUSSION NOS	1	$ 53,796.90
840.8	SPRAIN SHOULDER/ARM NEC	2	$ 30,008.63
814.01	FX NAVICULAR, WRIST-CLOS	1	$ 28,701.47
727.04	RADIAL STYLOID TENOSYNOV	1	$ 28,261.12
847.2	SPRAIN LUMBAR REGION	14	$ 24,380.36
844.2	SPRAIN CRUCIATE LIG KNEE	1	$ 22,087.99
836.1	TEAR LAT MENISC KNEE-CUR	2	$ 21,768.02
812.01	FX SURG NCK HUMERUS-CLOS	1	$ 21,116.59
807.04	FRACTURE FOUR RIBS-CLOSE	1	$ 18,505.46

APPENDIX CC: FALLS TO LOWER LEVEL- LEADING INJURIES BY TOTAL COST

ICD code	ICD description	Count	Total cost
801.26	CL SKUL BASE FX-COMA NOS	1	$ 425,300.10
801.09	CL SKULL BASE FX-CONCUSS	1	$ 221,161.18
722	INTERVERTEBRAL DISC DIS	1	$ 203,952.97
840.4	SPRAIN ROTATOR CUFF	2	$ 178,207.78
844.2	SPRAIN CRUCIATE LIG KNEE	4	$ 165,353.19
805.6	FX SACRUM/COCCYX-CLOSED	1	$ 164,297.00
824.7	FX TRIMALLEOLAR-OPEN	1	$ 154,162.37
722.1	THORAC/LUMB DISC DISPLAC	2	$ 70,510.56
843.9	SPRAIN HIP & THIGH NOS	1	$ 64,750.97
844.9	SPRAIN OF KNEE & LEG NOS	6	$ 64,719.54
840.6	SPRAIN SUPRASPINATUS	1	$ 61,567.89
847.2	SPRAIN LUMBAR REGION	12	$ 48,940.69
825	FX OF TARSAL/METATARSAL	1	$ 46,025.20
553.21	INCISIONAL HERNIA	1	$ 19,905.70
815	METACARPAL FRACTURE	1	$ 13,327.10

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