

# An Analysis of Workplace Injury and Job Tenure in the Transportation and Warehousing Sector Using Tennessee Workers' Compensation Claims from 2014-2016

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# 1 Introduction

The Construction Industry Research and Policy Center (CIRPC) at the University of Tennessee, Knoxville received a grant from the Centers for Disease Control - National Institute of Occupational Safety and Health (NIOSH) to use Tennessee workers' compensation (WC) claims data for occupational injury<sup>1</sup> surveillance and prevention. This report provides a brief overview of the private industry WC claims filed within the Tennessee transportation and warehousing sector for 2014-2016.

A NIOSH initiative exists to provide statistical information regarding workplace injuries that may supplement the Survey of Occupational Injuries and Illnesses (SOII) information currently assembled by the Bureau of Labor Statistics (BLS) since the SOII is only a sampling survey. Since 2015, NIOSH has awarded a number of grants to states to encourage the additional utilization of WC claims information in those states. In the summer of 2016, a grant was awarded to CIRPC that resulted in an agreement with the Tennessee Bureau of Workers' Compensation to make this information available subject to agreed-upon confidentiality limits. By combining the WC information with unemployment insurance records, it is possible to perform injury surveillance with respect to the injured employee's industry, employer size, age, and several injury characteristics including job tenure.

This report will examine several of these injury dimensions and their relationship to job tenure.<sup>2</sup> When tenure is mentioned in safety research, it is generally found that new workers are more likely to be injured on the job than those with greater experience. Unfortunately, in these studies details are frequently missing that would help in understanding this phenomenon and in documenting a possible remedy. For the most part, the studies and available data relate to economy-wide issues and fail to consider injury cause or impact.

It is our hope that this report will be used by the transportation sector<sup>3</sup> to better understand the major sources (causes) of injury, the most prevalent nature (type) of injuries sustained, the most frequently injured body parts, and the relationship between job tenure and injury. A better understanding of these factors can better inform the Tennessee transportation sector's safety initiatives.

## 2 Key Findings and Recommendations

The key findings of this report include:

1. Lifting and strains<sup>4</sup> were the leading sources/causes of injury in transportation. Recommendation: Emphasize training on lifting techniques and use work modifications to reduce strains on the bodies of workers.
2. The lower back and shoulders were the most frequently injured body parts. Lifting (back) and cumulative stresses (shoulders) are likely factors. Recommendation: As above, provide training on lifting best practices and modify work procedures to reduce physical stresses.
3. About eight percent of all claims required an emergency room visit. Recommendation: Have protocols in place to ensure injured workers requiring emergency care receive rapid and safe transport.
4. Transportation had more fatalities than any other NAICS sector and most were motor vehicle accidents. Thirty-six percent of those fatally injured were in their first year with their employer. Recommendation: Ensure drivers adhere to mandatory rest periods and other limits on driving time. Conduct pre-employment and periodic motor vehicle record checks on all drivers of company vehicles.
5. Workers were especially vulnerable to injury during their first year. Forty percent of all claims in transportation were made by such workers. Smaller employers had even higher first-year injury proportions. Recommendation: Provide company orientation 'onboarding' and consider assigning new employees a trusted employee as a 'mentor' in their early weeks.
6. As a proportion of all injuries, non-fatal severe injuries were approximately ten percent. Almost half occurred to first-year employees. Recommendation: Every firm is self-insured with its own safety resources or has a WC insurer with loss control expertise. The firm should engage all available resources to institute and maintain best practices in occupational safety and pre-employment screening.

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<sup>1</sup>In this document, the term 'injury' may mean injury and/or illness.

<sup>2</sup>In this study, the concept of 'job tenure' relates to employment with a given employer and not employment with any employer or in a particular craft or occupation with a given employer.

<sup>3</sup>North American Industry Classification System - the two-digit sector(s) 48, 49 represent(s) transportation and warehousing. For the remainder of this document, 'transportation' shall be used in lieu of 'transportation and warehousing.'

<sup>4</sup>We differentiate between strain as a cause and strain as a type. The former is an overexertion and the latter can be defined as an overstretching of some part of the musculature.

Table 1: NAICS Industry Injury Rates - 2016 BLS Rates vs. 2014-2016 Work Comp Rates\*

Naics2	Sector Description	2016 BLS Rate	2014-2016 Work Comp Rate
10	All Industries	2.9	2.5
11	agriculture	1.9	3.5
21	mining	1.6	2.4
22	utilities	6.3	7.5
23	construction	2.6	2.8
31-33	manufacturing	3.7	2.7
42	wholesale trade	2.8	2.8
44-45	retail trade	3.1	2.8
48-49	transportation	4.7	3.9
51	information	1.7	0.8
52	finance	0.4	0.5
53	real estate	1.7	2.3
54	professional	NA	1.3
55	management	0.5	3.2
56	administrative	2.2	2.9
61	educational services	2.3	1.7
62	health care	3.9	2.9
71	arts	4.3	3.3
72	food services	2.6	2.1
81	other services	1.9	1.8

\* Workers' compensation rates reflect only the matched portion (78.3 percent) of compensable, private claims in the WC universe.

### 3 Background

The BLS already publishes SOII injury rates for many industries but rates calculated with WC data can be an important supplement. Table 1 lists the Tennessee private sector BLS rates and the 2014-2016 WC counterparts. The BLS and WC composite rates for all Tennessee private sector employees are shown at the top of the table as 2.9 and 2.5 per 100 full-time equivalent (FTE) workers respectively. In making comparisons, differences in the two calculations must be considered. They differ in several ways. Here are a few:

- BLS rates are sample estimates and are subject to sampling error.
- WC industry rate numerators/counts in this report contain 'matched' claims only and are understated unless extrapolated to compensate.
- WC industry rates are adjusted upward/downward according to the industry's average annual working hours.<sup>5</sup>

Since the WC 'All Industries' rate represents only the matched portion of private sector claims, the true rate will be larger. Using linear extrapolation to adjust for unmatched claims (of 22 percent) yields an estimated rate of 3.2 per 100 FTE.

In 2016, the BLS rate per 100 FTE workers in the transportation sector was 4.7 per 100 FTE. By comparison, the rate using the Tennessee 2014-2016 WC claims data was 3.9. Adjusting with linear extrapolation as before yields a rate of 5.0 per 100 FTE. The WC rates include all self-reported claims and are more comprehensive than a sample estimate.

### 4 Data and Data Limitations

State WC systems generally collect First Report of Injury Information (FROI) in a standardized electronic format. The first report contains sixty-eight fields to identify characteristics of the claimant and employer as well as specific

<sup>5</sup>Data on industry annual working hours from the 2016 American Community Survey (ACS) PUMS.

details of the injury. Often a short narrative is also included. Tennessee follows this IAIABC electronic protocol for claim submission.<sup>6</sup>

During 2014-2016, there were 263,580 compensable claims received for all industries.<sup>7</sup> Of these, 22 percent could not be matched to a specific industry and therefore not included in the analysis. Of the matched claims, 18,957<sup>8</sup> are transportation sector claims (NAICS 48, 49) within the private sector.<sup>9</sup> Over 70 percent of the transportation claimants were male.

Though more comprehensive than the BLS sampling, these WC data have limitations of their own. In addition to the unmatched claims mentioned previously, there are missing data within individual claims. In fact, certain data fields have significant numbers of missing observations. For example, in the transportation sector, 10 percent of the claims have missing values needed to determine employee tenure at the time of injury. Report results, including those related to tenure, should not be affected significantly assuming that missing values occur randomly. Some injuries go unreported, and it is not known how this affects results.

There are at least two other important limitations of the data. First, older workers and those with longer tenure may not be exposed to the same hazards as new workers. Second, the claim data can be used to profile only injured workers. Though there is some public information on workforce age distribution and median tenure, we know little about other characteristics of workers not injured.

## 5 Investigative Focus

This study examined specific injury information and related that to a number of factors traditionally examined, such as nature and cause of injury, but also allowed consideration of tenure with the employer. In addition, it related these reported injuries to the size of the employer and other employment characteristics.

The WC data include all industries but this report focused on the transportation sector. Of all injuries, a substantial proportion were reported by new workers during the first year of employment with their current employer. Recognition of this fact, along with other relationships found in the data (such as employer size, NAICS code, and initial treatment), may have relevance, for example, to the nature of new worker training or onboarding.

The data available from the FROI allowed consideration of the following characteristics:

- Body part injured along with injury cause and type
- Age group
- NAICS industry and firm size
- Tenure with employer

## 6 Findings on Injury-Tenure Relationship

In BLS publication USDL 16-1867, the January 2016 median tenure reported for the national transportation industry was 4.4 years and 23 percent of workers (across all industries) had one year or less of tenure. Figure 1 shows that a substantial proportion (40 percent) of Tennessee transportation injuries occurred during the first year with an employer. Assuming the Tennessee tenure distribution approximates the national distribution, the proportion of early injuries is significant.

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<sup>6</sup>The International Association of Industrial Accident Boards and Commissions, or IAIABC, is an association of workers' compensation jurisdictional regulatory agencies.

<sup>7</sup>See the Appendix for the structure of the claim transactions.

<sup>8</sup>Sector tables throughout this document may sum to less than 18,957 claims because of missing observations or smaller subcategories that are not shown for brevity.

<sup>9</sup>Since 22 percent of all claims received could not be matched to a specific industry, the total claims in the private transportation sector likely exceeded 18,957 by a similar percentage.



Figure 1: Cumulative Proportion of Injuries By Tenure With Employer



Figure 2: Cumulative Proportion of First-Year Injuries By Tenure With Employer (0 to 12 Months only)

Table 2: Claims by Age

Age Group	Tenure - 1 Year or Less	All Tenure Lengths	
	Count	Total Count	First Year Prop.
16-19 years	487	544	0.9
20-24 years	1240	2008	0.62
25-34 years	1717	3292	0.52
35-44 years	1355	3450	0.39
45-54 years	1291	4496	0.29
55-64 years	607	2805	0.22
65+ years	114	500	0.23

Table 3: First-Year Injuries by Firm Size

Firm Size	Tenure - 1 Year or Less	All Tenure Lengths	
	Count	Total Count	First Year Prop.
0-4	147	313	0.47
5-9	98	209	0.47
10-19	148	292	0.51
20-49	365	751	0.49
50-99	456	993	0.46
100-249	458	1177	0.39
250-499	469	2061	0.23
500-999	463	1378	0.34
1000+	4221	9938	0.42

To further illustrate the increased risk to new employees, consider the injury distribution within the first year. Figure 2 includes only first-year injuries and shows that about 45 percent of the first-year injuries occurred during the first three months. Clearly the initial months with an employer were critical.

Table 2 shows injuries that occurred for short-tenured (i.e. less than one year) employees by age group as a proportion of all injured employees in the group. That proportion generally decreased by age. Workers under 35 suffered a greater proportion of first-year injuries than the first-year baseline proportion of 0.4 but this does not necessarily mean that shorter tenure was less significant for older employees. Since we know little about the tenure distribution of the uninjured employees, these proportions indicate nothing about the relative risk of short-tenured employees within a particular age group. For example, if short-tenured employees in a particular group suffered 30 percent of the injuries but composed only 15 percent of the total, their relative risk would have been quite high. Therefore, the effect of tenure combined with age cannot be determined with these data. Other studies have shown that though older workers have lower total rates of injury, their new-worker rate is higher than the youngest workers.<sup>10</sup> A companion analysis to this report,<sup>11</sup> found that the 45-54 age group had the greatest injury risk among new workers.

The data show that size of the employer may make a difference for injuries to new employees. Table 3 indicates the proportion of first-year injuries begins to decrease as the firm size reaches 20 employees and decreases significantly at 100 employees. Larger firms are usually thought to expend more effort in training new employees. Firms with 10-19 employees had first-year employees reporting injuries in a greater proportion than other groups. Firms with less than 10 employees had slightly lower numbers than the groups spanning 10-49.

The fact that job tenure is a factor suggests that cumulative industry experience may also have an effect. In other words, are older (and more experienced) employees injured less frequently than their proportion in the workforce?

Using age as a proxy for experience, Figure 3, shows both the transportation industry's age distribution for workers in Tennessee<sup>12</sup> (dashed line) and the proportion of injuries by age (solid line). Workers older than 55 suffered fewer injuries than their proportionate share while the opposite was true for those younger than 55. Older

<sup>10</sup>Morassaei, Sara, et al. "Examining job tenure and lost-time claim rates in Ontario, Canada, over a 10-year period, 1999–2008." *Occup Environ Med* 70.3 (2013): 171-178.

<sup>11</sup>Taylor, Edward. "An Old Problem for New Workers, 2014-2016", July 2019

<sup>12</sup>Age data from the 2016 American Community Survey (ACS) PUMS data.



workers seem to fare better overall when tenure is not considered.



Figure 3: Proportion of Injuries and Workers By Age

Table 4: Injuries by Body Part - Top 10 Categories

Body Part	Tenure - 1 Year or Less			Tenure - More than 1 Year		
	Count	Freq.	Rank	Count	Freq.	Rank
LOWER BACK AREA (MUSCLES)	833	0.122	1	1301	0.126	1
SHOULDER(S)	574	0.084	2	990	0.096	2
KNEE	484	0.071	4	898	0.087	3
MULTIPLE BODY PARTS	549	0.080	3	796	0.077	4
FINGER(S)	428	0.063	5	539	0.052	5
ANKLE	368	0.054	6	531	0.052	6
FOOT	352	0.052	7	467	0.045	7
WRIST	259	0.038	9	361	0.035	8
HAND	290	0.042	8	360	0.035	9
MULTIPLE INJURIES TO HEAD	245	0.036	10	343	0.033	10

It is informative to categorize injuries across various other dimensions to see if tenure affects the category rank order. Consider the dimensions body part, injury type, and cause. The ten most commonly injured body parts are shown in Table 4 for workers with more and less than one year tenure. Note the rank order is similar for first year workers.

For type of injury (e.g. sprain, cut, etc.) and cause of injury (e.g. fall, slip, exertion, etc.), see Tables 5 and 6. In the former, first-year rankings closely approximate the ranking structure for other periods. In the latter, there is some rank variation. Not surprisingly, sprains, contusions, strains, and lacerations rank among the most frequent injury types and the lower back was the most frequent body part injured. It is interesting that lifting was one of the top two causes. One possible interpretation is that workers lifting heavy objects resulted in strains/overexertions that became musculoskeletal injuries to the lower back.

Table 5: Injuries by Type - Top 10 Categories

Injury Nature	Tenure - 1 Year or Less			Tenure - More than 1 Year		
	Count	Freq.	Rank	Count	Freq.	Rank
STRAIN	1955	0.286	1	2945	0.286	1
CONTUSION	1427	0.209	2	1842	0.179	2
SPRAIN	967	0.142	3	1495	0.145	3
ALL OTHER SPECIFIC INJURIES NOC	604	0.088	4	1255	0.122	4
LACERATION	590	0.086	5	876	0.085	5
FRACTURE	259	0.038	6	354	0.034	6
MULTIPLE PHYSICAL INJURIES ONLY	223	0.033	7	319	0.031	7
INFLAMMATION	169	0.025	8	292	0.028	8
PUNCTURE	122	0.018	9	215	0.021	9
CRUSHING	72	0.011	11	100	0.010	10

Table 6: Injuries by Cause - Top 10 Categories

Injury Cause	Tenure - 1 Year or Less			Tenure - More than 1 Year		
	Count	Freq.	Rank	Count	Freq.	Rank
STRAIN OR INJURY BY, NOC	469	0.069	2	999	0.097	1
LIFTING	703	0.103	1	986	0.096	2
PUSHING OR PULLING	378	0.055	5	792	0.077	3
OTHER - MISCELLANEOUS, NOC	334	0.049	8	688	0.067	4
FALL, SLIP OR TRIP, NOC	340	0.050	6	669	0.065	5
STRUCK OR INJURED, NOC	340	0.050	6	523	0.051	6
ON SAME LEVEL	202	0.030	14	507	0.049	7
CAUGHT IN, UNDER OR BETWEEN, NOC	262	0.038	11	414	0.040	8
OBJECT BEING LIFTED OR HANDLED	402	0.059	4	414	0.040	8
FALLING OR FLYING OBJECT	416	0.061	3	390	0.038	10

It is useful to know that the rank order of injuries sustained by short-tenured employees do not appear to have varied significantly from those with longer tenure with respect to body part, nature, and cause of injury.



Figure 4: Word Cloud of Injury Narratives

Most claims in the data contain an associated injury narrative and the word cloud in Figure 4 features the most common words found in the narratives. The cloud reinforces the Table 4 results by showing ‘back’ as the most prominent. The nouns ‘package’ and ‘box’ appear as does the verb ‘lift’. All these things suggest that lifting injuries are a major concern in transportation.

## 7 Injury Severity

To explore, non-fatal injury severity, Table 7 shows the various initial treatment modes given in the claims data. Using these modes as a proxy for severity, we assumed those claims associated with future major medical, hospitalization, and emergency evaluation represent the most severe injuries. For hospitalization and emergency, first-year injury proportions approximated or exceeded those of the first-year baseline of 0.4.

As stated earlier, job tenure is unknown for 10 percent of transportation sector claims. For claims containing such information, Table 7 indicates that first-year employees received almost half of all hospitalization and emergency evaluation treatments.

For fatal injuries, there were 25 incidents during the study period. In this sector, 9 (36 percent) fatalities had employer service of less than one year. Not surprisingly, Table 8 indicates that vehicle-related fatalities predominate.

Table 7: Injuries by Initial Treatment Type

Type Treatment	Tenure - 1 Year or Less	All Tenure Lengths	
	Count	Total Count	First Year Prop.
Emergency Evaluation	677	1400	0.48
Hospitalization	45	94	0.48
Future Major Medical	21	135	0.16
Minor Clinic	4672	11894	0.39
Minor Onsite by Employer	196	457	0.43
No Medical Treatment	692	1962	0.35
Unknown	522	1170	0.45

Table 8: Fatal Injuries by Cause

Type	Tenure - 1 Year or Less	All Tenure Lengths
	Count	Count
MOTOR VEHICLE, NOC	3	9
CAUGHT IN, UNDER OR BETWEEN, NOC	1	3
MOTOR VEHICLE	1	2
OTHER THAN PHYSICAL CAUSE OF INJURY	1	2
COLLAPSING MATERIALS	1	1
COLLISION WITH A FIXED OBJECT	1	1
OTHER - MISCELLANEOUS, NOC	1	1
COLLISION OR SIDESWIPE WITH ANOTHER VEHICLE	NA	2
CONTACT WITH, NOC	NA	1
CUMULATIVE, NOC (ALL OTHER)	NA	1
STRUCK OR INJURED, NOC	NA	1
VEHICLE UPSET (OVERTURNED OR JACKKNIFED)	NA	1

## 8 Other Considerations

For some industries (e.g. construction, agriculture, etc), there can be seasonality in the pattern of injuries or variation by day of the week. A quick review of Figures 5 and 6 indicates no unusual patterns except for a small spike in February 2015. Further investigation reveals this spike came from falls resulting from an ice storm that hit the region.

## 9 Final Thoughts

From the 2014-2016 Tennessee WC claims data, we highlight these items for consideration by the transportation sector.

1. Among two-digit NAICS industries, transportation was above average for WC injury frequency with a rate of 3.9 per 100 FTE (extrapolated rate is 5.0 per 100 FTE).
2. Except for a spike in February 2015 (see Figure 5) when ice and snow caused a number of falls, injuries did not have much variability month-to-month.
3. Strains of the musculature were the most common type of injury and happened at almost one and one-half times the rate of the second most common (contusions). The lower back was the most common body part to be injured with shoulders second.
4. Employees with job tenure of less than one year sustained 40 percent of all injuries in transportation.
5. The job injury-tenure relationship varied with the size of employer. Firms with less than 100 employees had almost half of their injuries suffered by first-year employees vs. less than 40 percent for those with more than 100 employees.
6. First-year injuries had rank orders for injury type almost identical to those of the set of all injuries. Injury cause was more variable between the groups but lifting and strains were first or second in both groups.
7. Workers older than 55 had lower overall rates of injury than their younger peers.

Further, transportation is different than most industries because of more exposure to moving vehicle accidents. These accidents perennially cause more workplace fatalities than any other type. Further, the extreme physical demands of loading/unloading cargo in addition to extended driving spells leave newly hired workers vulnerable in the early portion of their job tenure with an employer. Employees working in smaller firms are more at risk. The industry should develop practices (e.g. new employee onboarding, mentorship, etc.) that target these at-risk workers.

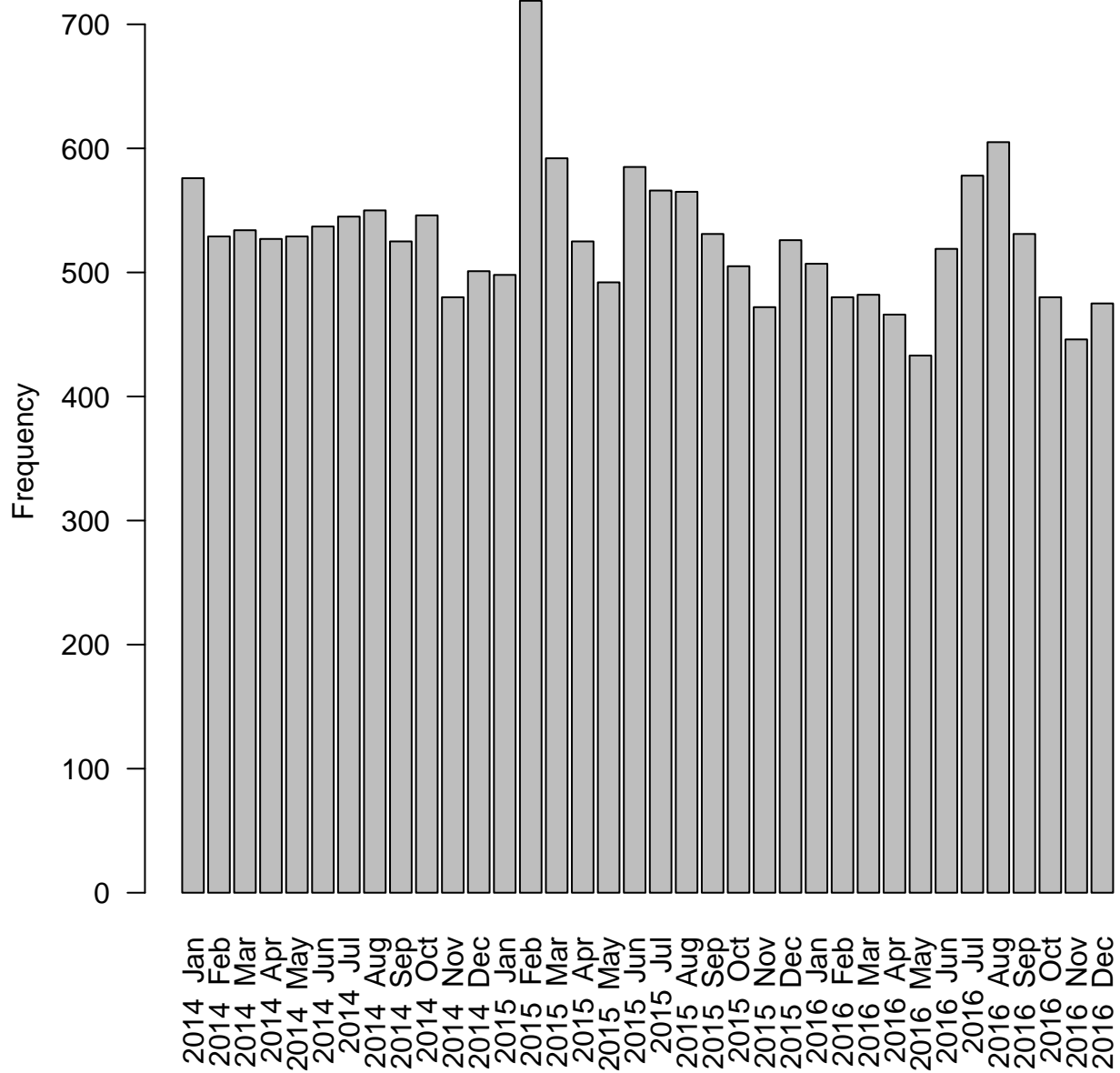


Figure 5: Monthly Distribution of Injuries

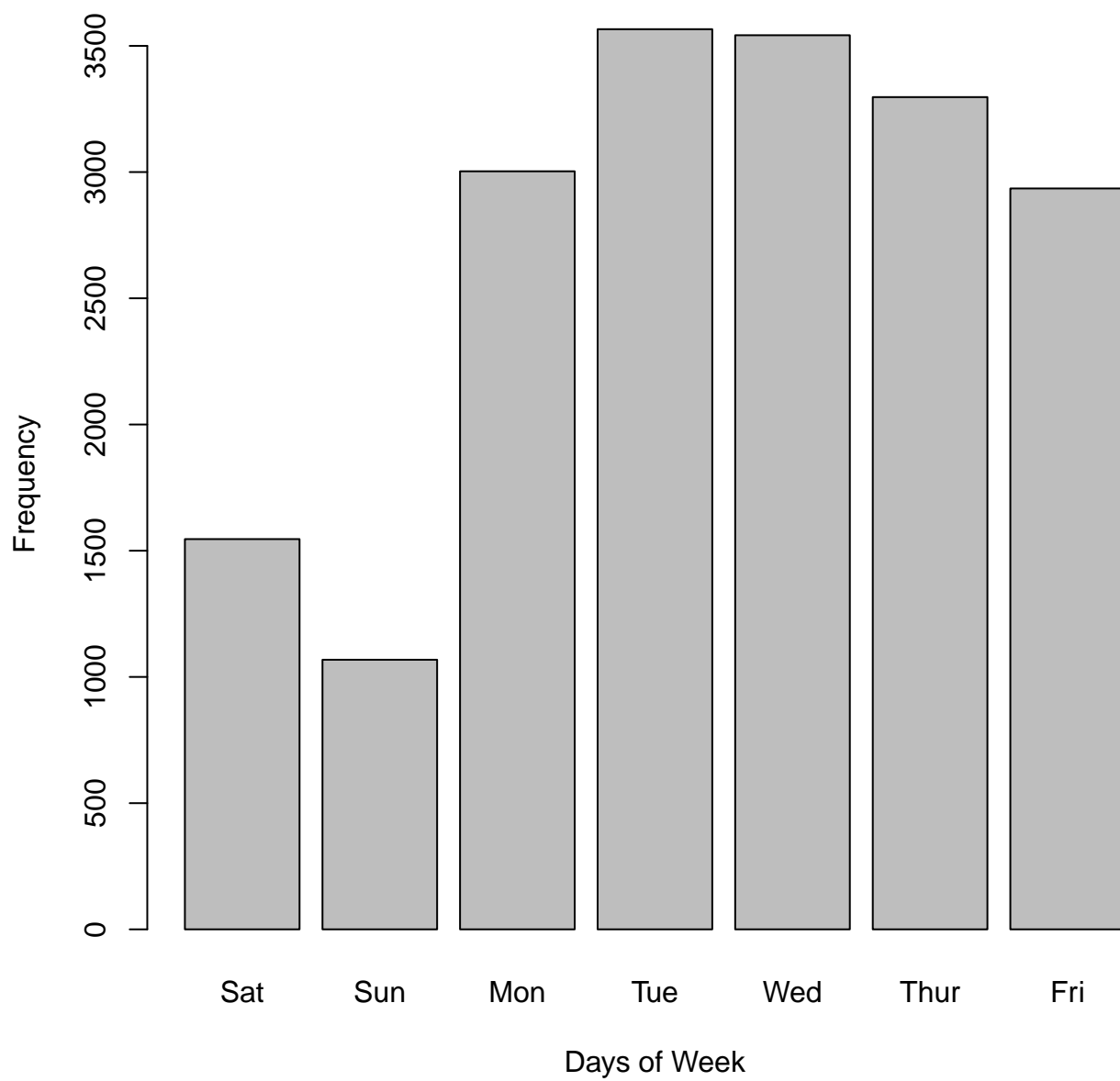


Figure 6: Weekday Distribution of Injuries



10 Appendix

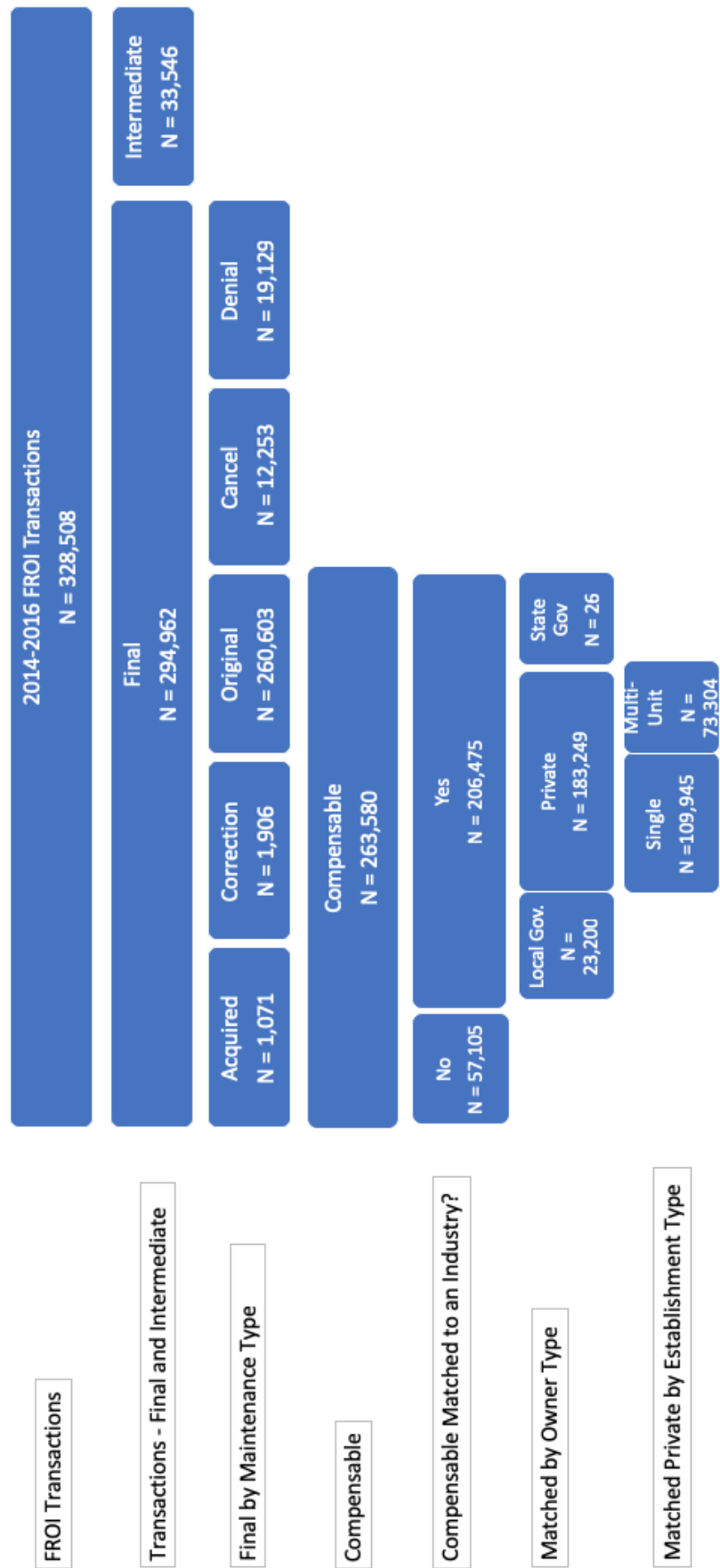


Figure 7: Structure of 2014-2016 FROI Claim Transactions