

INJURED EMPLOYEES WITH MULTIPLE INJURIES AND CLAIMS IN THE TEXAS WORKERS' COMPENSATION SYSTEM



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- ★ litigation and controversy related to workers' compensation;
- ★ insurance rates and rate-making procedures;
- ★ rehabilitation and reemployment of injured employees;
- ★ the quality and cost of medical benefits;
- ★ employer participation in the workers' compensation system;
- ★ employment health and safety issues; and
- ★ other matters relevant to the cost, quality, and operational effectiveness of the workers' compensation system.

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Executive Summary

The goals of this report are to investigate how common multiple injury claims are in the Texas workers' compensation system, to estimate reinjury rates by demographic and injury characteristics, and to examine risk factors of multiple injury by comparing injured employees of single injury with those of multiple injuries.

Data and Methodology

The data consists of medical billing and claims data from Injury Year 1998 to 2017. Injured employees were grouped into a control group with a single injury and a case group with a second injury within four years of the first injury. For costs and utilization metrics, we evaluated services for 12 months after injury. This timeframe for analysis allowed a comparative set of claims covering a period from 2006 to 2012 injury years. Reinjury rates were calculated within this case-control study model, and for a set of factors, relative odds of having a second injury were estimated using logistic regression.

Patterns and Frequencies of Multiple Injuries

- About 40 percent of new claims in each year were claims by those individuals who had at least one previous injury and claim. Among the new claims without a past injury, about 30 percent of them would have a second injury in 10 years.
- Considering all available medical and claims data from 1998 to 2017, 53 percent of all claims and 51 percent of medical costs were associated with multiple injuries.

Reinjury Rates

- The reinjury rate was significantly higher for those in public administration and health care industries. The reinjury rate was also notably higher among medical-only claims, and those with shoulder injury.
- The injury rate was slightly higher among males, younger employees, and pre-formulary claims.

Benefits, Costs and Service Utilization by Reinjury Status

- Medical and income benefit costs associated with the first injury of multiple injury cases were significantly lower than the similar costs of single injury employees.
- However, sum costs of first and second injuries for multiple injury employees were significantly higher than those of the single injury cases.

Pharmacy Services and Multiple Injuries

- After the pharmacy closed formulary, the usage of status "N" drugs decreased significantly among both single injury and multiple injury claims.
- Comparing first injuries, utilization of central nervous systems (CNS) drugs and opioids was slightly higher among single injury claims than multiple injury claims, in part because single injury claims were more likely to have severe injuries. Utilization of NSAIDs and musculoskeletal drugs was higher among multiple injury claims.

- Total morphine milligram equivalent (MME) dosage of opioids was higher among single injury claims than multiple injury claims. While average daily doses were similar in both claim groups, single injury claims received opioids for a longer period. The percentage of high dosage (90+ MMEs) prescriptions was about the same for both claim groups. This opioid utilization pattern appears to be affected mostly by the fact that the single injury group had a higher share of more severe, lost time claims than the multiple injury group.

Estimating Risks of Multiple Injuries

- Logistic regression analyses showed that odds of having a second injury was higher for male gender, younger age, shoulder injury type, and pre-formulary claims.
- Employees working in the Public Administration industry sector had 2.13 times greater odds of reporting a second injury than those in all other industries.

Concluding Remarks

- Currently available data showed that multiple injuries are quite common and costly, and that many injured employees suffer from repeated injuries. Further research should assess whether and how repeated injuries could be reduced.
- Evaluating the cause and effect and the exact process by which some factors affect reinjury will require more detailed studies with improved data. Current claim-centered data is extensive in medical costs, but data on income benefits and disability duration is often incomplete. In addition, employee data regarding demographic, employer, and industry characteristics are partial and limited. Results in this report should be viewed within these data limitations.

1. Introduction

If an employer has workers' compensation coverage, then an employee can file a claim when he or she is injured on the job or develops a work-related illness.¹ Filing a workers' compensation claim is similar to filing other insurance claims after an incident. When the same employee suffers a second injury, a separate claim is filed. As a result, most workers' compensation administrative data are organized by claim, rather than by employee, and analyses and reviews of the system characteristics are also done at a claim level.

There are about 200,000 new claims in each year in the Texas workers' compensation system, representing about 2 percent of the covered Texas employees. More than half of these claims are for minor injuries involving a short period of medical treatment without any lost time from work. However, it is common to find some injured employees having multiple injuries and claims stemming from distinct incidents. While claim trends and patterns have been extensively analyzed, the demographic, medical utilization, and injury characteristics of injured employees with multiple injuries have not received similar attention. This study examines multiple injuries and claims grouped by the individual injured employee, rather than by separate and distinct claims.

Definitions

In this report, “**multiple injuries**” of an injured employee refer to injuries from distinct accidents, or incidents, which resulted in separate workers' compensation claims for the same individual. Multiple injuries may be at the same or different body location (back, shoulder, foot, and so on), or of the same or different injury type (strain, dislocation, burn, and so on). Because of this inherent complexity, various terms have been used to describe multiple injuries in a number of circumstances:

- For Subsequent Injury Fund (SIF) purposes under Section 408.162, Labor Code, the Texas Workers' Compensation Act describes “subsequent” or second injury as a work-related injury to a person with a previous injury that together results in an injured employee's entitlement to lifetime income benefits. Due to the catastrophic nature of the injuries that result in lifetime income benefits, a “subsequent” injury usually involves a second injury to a different body location.²

¹ It was estimated in 2016 that 82 percent of the Texas private-sector, full-time employees have workers' compensation coverage. Including WC-mandatory public sector employees, the Texas workers' compensation system was estimated to cover more than 10 million Texas employees in 2016. For more information about how many employers and employees are covered by the Texas workers' compensation system, see “Employer Participation in the Texas Workers' Compensation System: 2016 Estimates” available at <http://www.tdi.texas.gov/reports/wcreg/index.html>. Texas is the only state in the U.S. where employers may or may not elect to participate in the workers' compensation system. The WC Research and Evaluation Group at TDI conducts employer surveys biennially to estimate this participation rate.

² For example, if an employee who lost a leg previously is hired and loses an arm because of a job-related injury, the employee would become eligible for lifetime income benefits for the resulting disability. Under the SIF rules,

- Some researchers categorize subsequent injury into three groups depending on injury location and type: “new” injury for different location, “local” injury for same location but different type, and “recurrent” injury for same location and same type.³
- The World Health Organization publishes the International Classification of Diseases (ICD), which is used to code and classify diagnoses and medical procedures in health care. The ICD contains references to “multiple injuries” to refer to injuries occurring simultaneously in multiple parts of the body.

Our definition of “multiple injuries” excludes simultaneous injuries used in the ICD coding system, but includes ‘recurrent’ injuries of same site and type at different times and “subsequent” injuries of different site and type. “Multiple injuries” also need to be distinguished from ‘cumulative’ injuries such as carpal tunnel syndrome or back injuries resulting from an exposure to repetitive and cumulative stresses. These cumulative injuries would result in one instance of claim with one, albeit often disputable, date of injury instead of multiple claims with different dates of injury.

“**Reinjury**” refers to the second and subsequent injury to an injured employee with a prior injury or claim. The “**reinjury rate**” is the rate at which an injured employee with a prior claim is injured again and submits another separate workers’ compensation claim.

Claims and Injuries: A unique claim is identified by the injured employee’s identification number (social security number) and a unique injury date. Therefore, a unique injury means a unique claim. In this sense, “injury” and “claim” may be used interchangeably in this report. In some cases, it may be difficult to determine an exact injury date (as in cumulative injuries), and, as a result, different health care providers may report different injury dates for the same person and injury. In other cases, different injury dates for the same injury may be reported because of data entry errors. To minimize effects of these cases, all potentially spurious multiple injury cases where an employee has claims with two injury dates that are separated by 10 days or less were excluded from the analysis. In other words, distinct injuries must be separated by more than 10 days in the reported data.

Timeframe: Measurements of reinjury rates depend on the timeframe used to select data. Reinjury rates within a five-year data span would be significantly lower than the rates calculated over a 10-year span. Therefore, reinjury rates have to be reported and compared within consistent timeframes. In this report, we first present the overall reinjury rates and patterns using all available data (in Section 2). Given the available data from 1998 to 2017, about 29 percent of the injured employees had multiple injuries, but they accounted for 53 percent of all workers’ compensation claims.

the employer is only liable for the benefit for the arm’s loss, and the Texas SIF will pay for lifetime benefits excluding the employer’s portion.

³ See “Subsequent injury definition, classification, and consequence” by Hamilton, GM et al., *Clin J Sport Med* 2011 Nov., 21(6):508-14. See also “Consensus statement on injury definitions and data collection procedures for studies of injuries in rugby union” by Colin W Fuller, et al., *Br J Sports Med* 2007;41:328-331.

To compare reinjury rates and costs by injury year, injury type, claim type, industry, and other variables in subsequent sections of this report, we considered those with a second injury within four years of the first injury as ‘multiple’ injury claims. While this four-year constraint allows more consistent comparisons across different control variables, it results in lower estimates of reinjury rates. About 19 percent of the injured employees experienced a second injury within four years after the first injury. This lower rate should be understood within the given timeframe.

Injury Year: Injury Year (IY) in this report is a fiscal injury year that begins on September 1 of the previous year and ends on August 31 of the following year. For example, the IY 2006 covers a period from September 1, 2005 to August 31, 2006. This is to make pre- and post-formulary comparison easier since the pharmacy closed formulary took effect on September 1, 2011.

Data and Methodological Notes

The goals of this report are to investigate how common multiple injury claims are in the Texas workers’ compensation system, to estimate reinjury rates by demographic and injury characteristics, and to examine costs and risk factors of multiple injuries by comparing injured employees of single injury with those of multiple injuries.

For this report, available data are mostly administrative health care data in the workers’ compensation system. This excludes group health and other data that may have relevance to multiple injuries. Medical data for all claims are submitted to the DWC, but more detailed claim reports to the DWC are required only for claims with any lost time from work. Thus, detailed demographic, employment and industry data are not available for medical-only claims without lost time.

Given available data, we use a case-control observational study design where injured employees with a second injury (the *cases*) are compared with those without a second injury (the *controls*). The *case* group consists of injured employees with at least a second injury within four years of the first injury. While our analysis is limited to the first and second injury, these employees may have a third and more injuries within the study period. Injured employees in the *control* group had only one injury and claim within the study period. We examine differences between the two groups in terms of demographic, injury type, health care, and other characteristics, and estimate the odds of having a second injury using logistic regression.⁴

There were more than 3 million unique injured employees in the Texas workers’ compensation medical data since 2006. This dataset was used for the overview statistics in Section 2. For comparative studies

⁴ Results of case-control studies are not as robust as those of randomized experiments or prospective cohort studies. However, given the data and resources available, this report will provide a general but relatively complete overview of the multiple injury cases in the Texas workers’ compensation system, and offer ample areas for future in-depth studies.

in Sections 3 to 5, the following data selection criteria were used to obtain a dataset of about a million employees. The dataset included those

- with identifiable, legitimate social security numbers;
- whose first injury occurred between 2006 and 2013;
- without a prior injury or claim before 2006; and
- that had only one injury between 2006 and 2017, or had multiple injuries with the second injury occurring after more than 10 days⁵ and within 4 years⁶ of the first injury.

All claims and bills that did not meet these conditions were removed from the dataset.

⁵ Claims are distinguished by injury date, and possible reporting errors may cause one to have different injury dates and claims, especially if the reported injury dates are different only by a few days. This condition of more than 10 days difference is used to exclude potential data errors. In some cases such as cumulative traumas (carpal tunnel syndrome or back injuries), there may be disputes as to the exact injury date. To the extent that the difference is 10 days or less, this condition may exclude such claims from our analysis.

⁶ If one has a second injury after more than 4 years from the first injury, these were deleted from analysis.

2. Patterns and Frequencies of Multiple Injuries

An injured employee is identified by a unique number (SSN), and a workers compensation claim is distinguished by a unique injury date in addition to an SSN. When some injured employees had multiple injuries or claims, there would be more claims than SSNs. In each injury year, the number of claims was slightly higher than the number of injured employees identified by a unique SSN (see Table 1).⁷ This data indicates that about five percent of the claims in each year belonged to injured employees with multiple injuries or claims in the same year. In addition, some individuals might have different injuries and claims in previous and future years. For this reason, the percentage of injured employees with multiple injuries may still be higher than five percent. We first measure how common multiple injuries are.

Table 1: Number of claims and injured employees by injury year

Injury Year	Number of unique claims	Number of unique injured employees
2006	234,626	221,739
2007	242,064	228,718
2008	242,016	228,503
2009	221,377	209,745
2010	215,083	203,814
2011	223,494	211,564
2012	221,999	210,467
2013	214,461	203,465
2014	216,466	205,077
2015	215,221	204,091
2016	212,164	201,376

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

Considering all injury years from 2006 to 2016, there were about three million unique injured employees and 4.7 million unique claims. Seventy-one percent of unique injured employees had only one claim while the remaining 29 percent of them had two or more claims (see Table 2). In terms of claims, 47 percent of the claims belonged to injured employees with only one injury while 53 percent of the claims belonged to injured employees with multiple injuries. In other words, the majority of workers' compensation claims came from injured employees with multiple injuries.

When all professional, hospital, and pharmacy costs associated with these claims were analyzed (by summing up all bills between 2006 and 2017), multiple injury cases accounted for 51 percent of the total medical costs. As a percentage, this share was highest in 2010 with 56.6 percent (see Figure 1). This share had a decreasing trend in recent years possibly because of the issue of limited timeframe for these claims whose costs may still occur and increase in future years. This latter possibility demonstrates the

⁷ These counts are compiled using professional medical bills. About four percent of all claims received only hospital or pharmacy benefits without any professional services. These cases involve legacy claims, fatal injuries or billing errors and are excluded from the analysis.

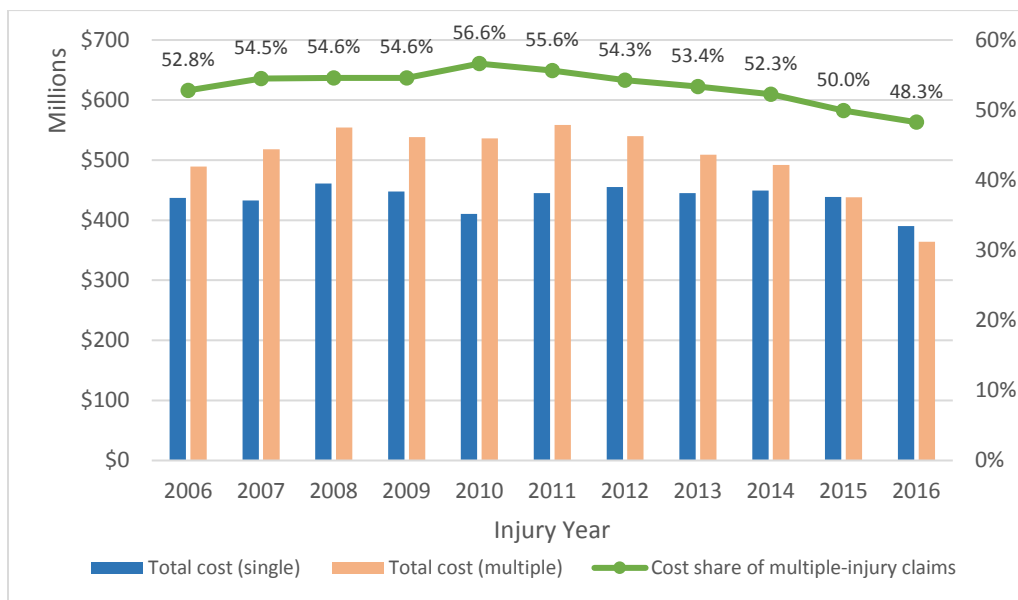
need to apply a uniform period of analysis (or maturity) to produce consistent results comparable across different injury years.

Table 2: Number of claims per injured employee, 2006 – 2016 injury years

Number of unique claims per injured employee	Number of injured employees	Percent of total injured employees	Number of unique claims	Percent of total claims
1	2,109,141	71.0%	2,109,141	46.9%
2	522,434	17.6%	1,044,868	23.2%
3	184,925	6.2%	554,775	12.3%
4	77,492	2.6%	309,968	6.9%
5	35,964	1.2%	179,820	4.0%
6+	40,735	1.4%	301,604	6.7%
Total	2,970,691	100.0%	4,500,176	100.0%

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

Figure 1: Total medical costs and cost shares by multiple injury status



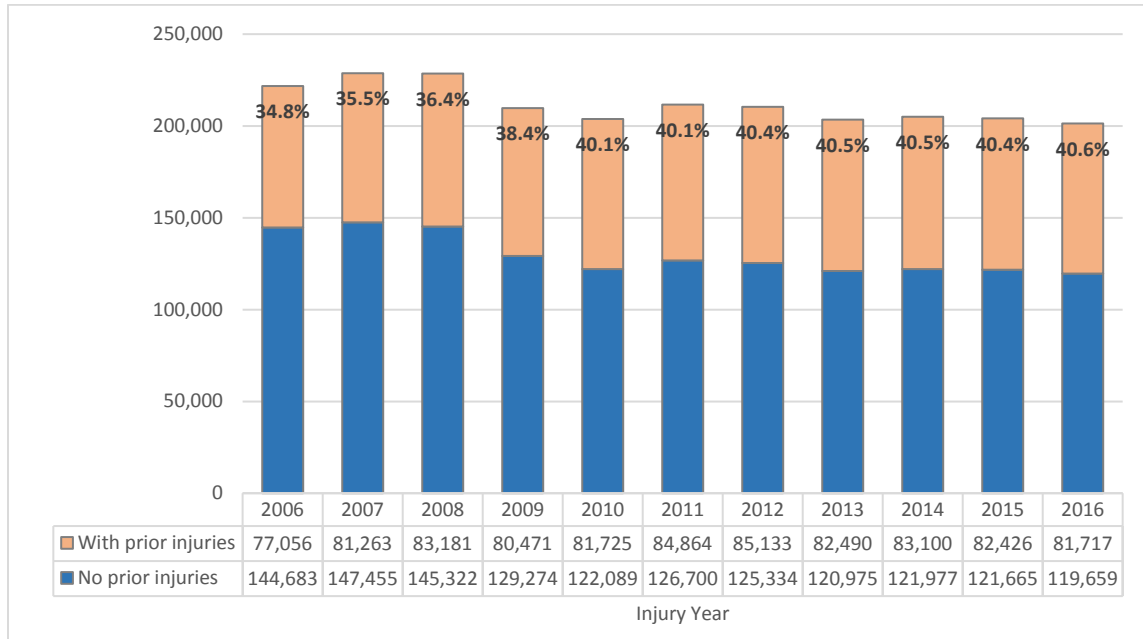
Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

Claims by Prior Injury Status

Identifying multiple injury status is limited by available data. Currently, past injury claims can be analyzed with claims data from 1998. Therefore, some of the claims identified as 'single' below may have past claims that occurred before 1998. Future repeat injuries may also occur after 2017. Given these limitations, past injury status was examined for claims since 2006, using claims data since 1998.

Among about 200,000 new claims in each injury year (including lost-time and medical-only claims), about 80,000 (40 percent) belonged to injured employees with at least one previous claim that occurred between 1998 and 2006 (see Figure 2). Slightly lower repeat injury rates for 2006 (34.8 percent) and 2007 (35.5 percent) may be due to the lack of data in these earlier years.

Figure 2: Claims with or without prior injuries

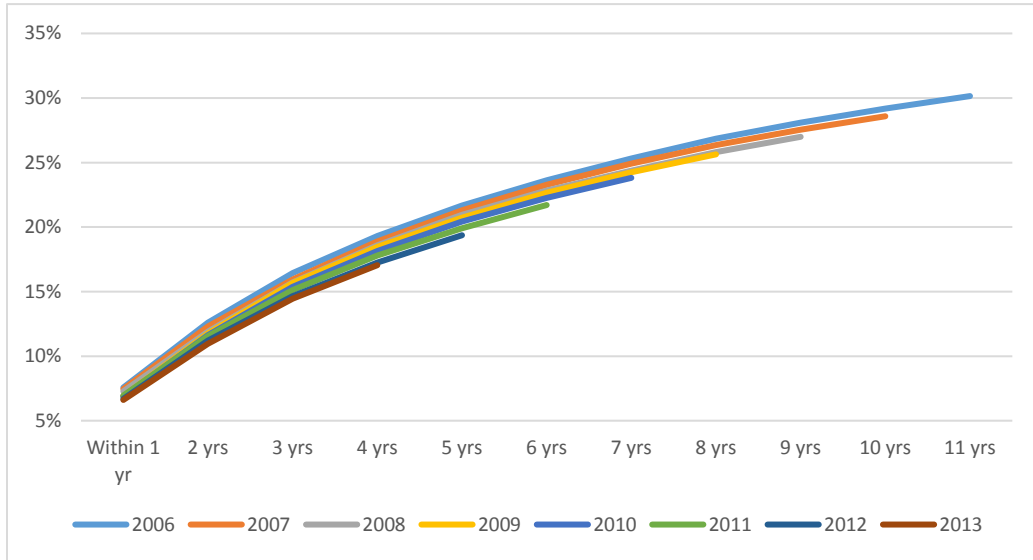


Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

Claims by Subsequent Injury Status

Even the “No prior injuries” claims (about 60 percent of the claims in each injury year in Figure 2) may have subsequent injuries in later years. Figure 3 shows the cumulative percentage of injured employees who experienced another injury in later years by the number of years between the first and second injuries. Within one year of the first injury, about 7.6 percent of these “No prior injuries” claims had a second injury; 13 percent in two years; and 30 percent within 11 years. The cumulative percentages are quite similar for all injury years even though percentages were slightly lower for recent years. The general trend indicates that the reinjury rates followed a consistent pattern, and that about 30 percent of the claims without a prior injury would experience a second injury in about 11 years.

Figure 3: Time between first and second injuries among two-claim injured employees, by injury year



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

What the previous analysis shows is that, about 40 percent of the claims in each injury year are multiple-injury cases having prior injuries, and even among the 60 percent without a prior injury, 30 percent of them would have another injury in the future. In short, about 58 percent of the claims in a given year may be considered multiple injury claims.⁸

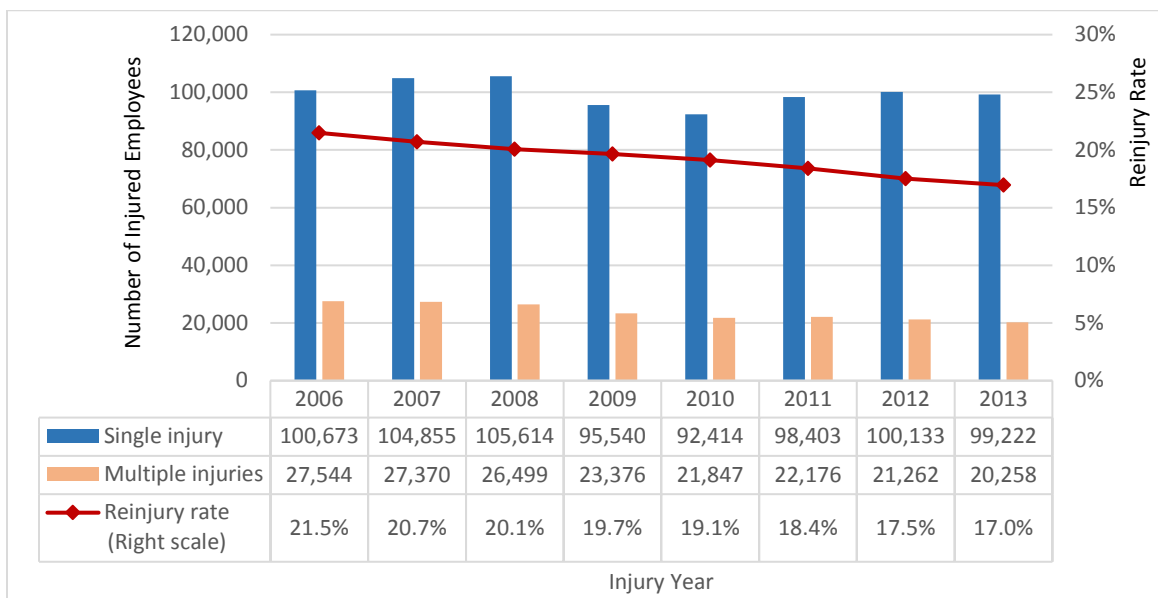
⁸ The final percentage of 58 percent is the sum of 40 percent for prior injuries and 18 percent (.6 x .3) for future injuries. A study on the workers’ compensation system in Alberta, Canada reported that 67.6 percent of initial claims in 1995 had recorded another claim by 2004. See “Second WCB claims: who is at risk?” by Nicola M. Cherry et al., *Canadian Journal of Public Health*, 2010; 101 (Suppl.): S53-S57. Another study for Victoria, Australia reported that 37 percent of initial claims between 1996 and 2000 resulted in more than one claim. See “Repeat workers’ compensation claims: risk factors, costs and work disability” by Rasa Ruseckaite and Alex Collie, *BMC Public Health* 2011, 11:492-499. Direct comparisons between different studies may be problematic because of the differences in data selection, timeframe, and industry and system characteristics. However, these studies indicate that multiple injury claims are common in workers’ compensation.

3. Reinjury Rates

Based on previous observations, we selected a subset of data consisting of (1) injured employees with only one injury in our data (single injury) cases, and (2) injured employees with a second injury within four years of the first injury. Note that the second group included those with three or more injuries as long as the second injury occurred within four years of the first injury. Those with a second injury after more than four years of the first injury were excluded from our analysis for simplicity and comparability. The following analysis of reinjury rates compares first and second injuries.

In 2006 injury year, there were about 100 thousand claims that did not have a second injury in four years (see Figure 4). There were also 27 thousand claims that had a second injury. The reinjury rate for claims in 2006 was 21.5 percent.⁹ The reinjury rate decreased slightly and consistently each year since 2006, reaching 17 percent in 2013. The main reason for this consistent decline appears to be related to data selection procedures.¹⁰ In all likelihood, the reinjury rate may be rather constant over the years.

Figure 4: Number of claims and reinjury rates by reinjury status



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

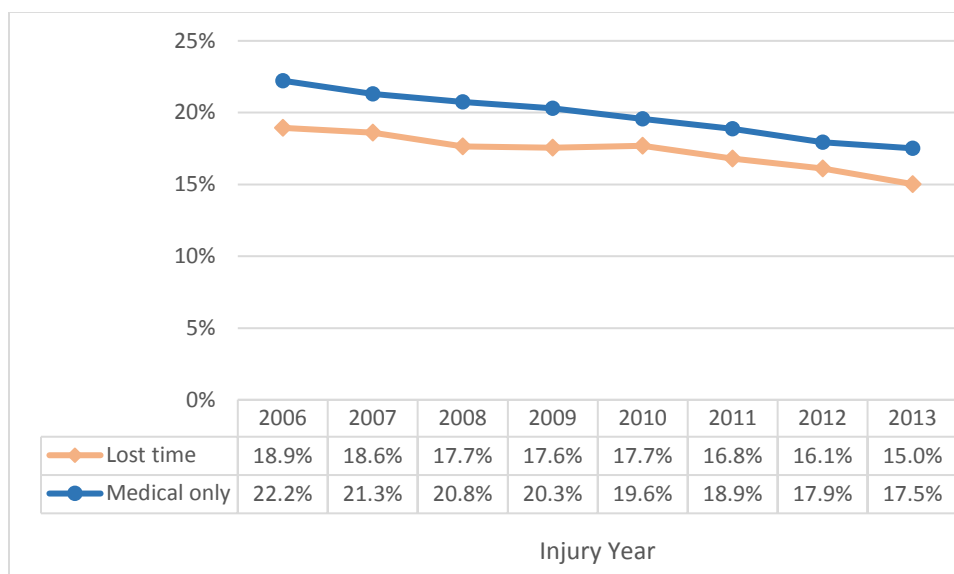
⁹ Note that the reinjury rate for 2006 would be 30 percent if we consider all data up to 2017 with 11 years to mature. However, the maximum time horizon for 2013 claims is only four years, and therefore 2006 and 2013 are not comparable. For this reason, reinjury rates are calculated within four years after the first injury. Those with a second injury after 4 years are excluded from analysis.

¹⁰ The reinjury rate is calculated as (the number of claims with multiple injuries) divided by (the number of claims with multiple injuries + the number of claims with single injury). The number of claims with single injury for 2013 is overstated because some of these may have a second injury after 2017. This results in an understated reinjury rate. On the other hand, the number of claims with single injury in earlier years is understated because some claims with a second injury after more than four years from the first injury are excluded.

Reinjury rates by Claim Type

Lost time claims are those with more than seven days of time away from work because of a work-related injury. These claims received income benefits. Medical only claims are those without income benefits.¹¹ These include claims with seven or less days of lost time, as well as claims without any lost time. The injuries for lost time claims tend to be more severe than those of medical only claims. The average reinjury rate was higher among medical only claims (see Figure 5). This may be due to various reasons. For example, severely injured employees may be more likely to be out of work, and thus out of workers' compensation system, for more than four years, which may decrease their exposure to additional work-related injuries. There may be other reasons that need to be explored in the future.

Figure 5: Reinjury rates by claim type



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

Reinjury Rates by Injury Type

Reinjury rates differed by type of injury. Considering all the study years (2006 through 2013 claims), the overall reinjury rate, regardless of injury type, was 18.8%. Injured employees whose first injury occurred to the shoulder, back, or knee had a slightly higher reinjury rate than the overall rate (see Figure 6).

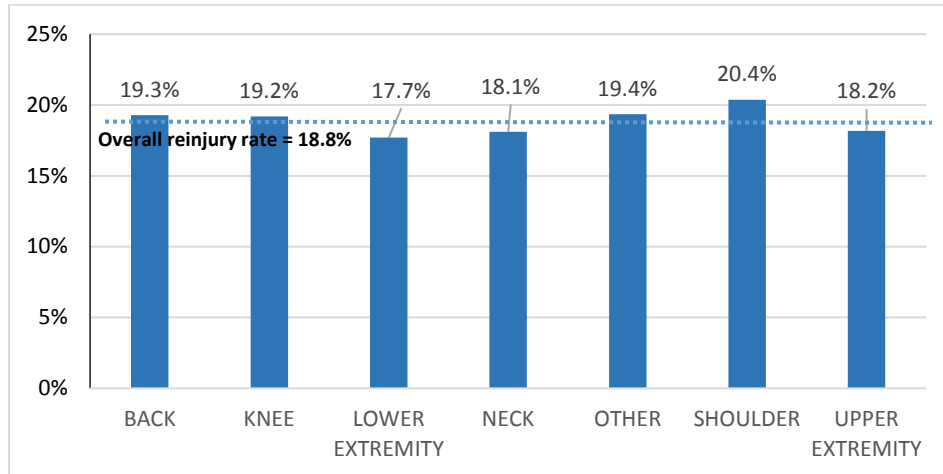
First and second injuries show a minor correlation. If the first and the second injuries were independent of each other, the share of back injuries for example, would not change.¹² But among the claims with a back injury as their first, 26.3 percent of them had a second back injury (see Table 3). This rate is much

¹¹ Medical only claims also include those with one to seven days of lost time, which is the state mandated waiting period before income benefits ("elimination period"). "Lost time" claims are also called income/indemnity claims.

¹² For example, 14.5 percent of the first injury cases were back injuries. If injury events were independent events, then we would expect that 14.5 percent of the second injury cases would also be back injuries.

higher than the 14.5 percent share of back injuries among all first injuries. Similarly, 16.9 percent of the claims with a knee injury as their first, also had a second knee injury, while knee injuries accounted for only 6.9 percent of all first injuries. There was a higher possibility of having a reinjury in the same body part.

Figure 6: Reinjury rates by injury type of the first injury, 2006–2013



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

Table 3: Share of claims by injury type, 2006–2013

Injury type, first injury	Share of claims, first injury	Share of claims, second injury						
		BACK	KNEE	LOWER EXTREM	NECK	OTHER	SHOULDER	UPPER EXTREM
BACK	14.5%	26.3%	6.5%	13.2%	4.0%	22.3%	6.8%	20.9%
KNEE	6.9%	12.6%	16.9%	16.8%	3.6%	20.9%	7.4%	21.9%
LOWER EXTREMITY	16.1%	13.7%	8.2%	19.8%	3.2%	23.7%	7.0%	24.4%
NECK	3.5%	17.1%	7.3%	13.1%	10.6%	23.5%	8.4%	20.0%
OTHER	24.4%	13.7%	6.6%	13.6%	3.2%	31.1%	6.5%	25.2%
SHOULDER	6.3%	14.0%	7.5%	13.7%	3.9%	22.3%	16.7%	22.0%
UPPER EXTREMITY	28.2%	13.3%	6.3%	14.1%	3.0%	24.3%	6.5%	32.5%

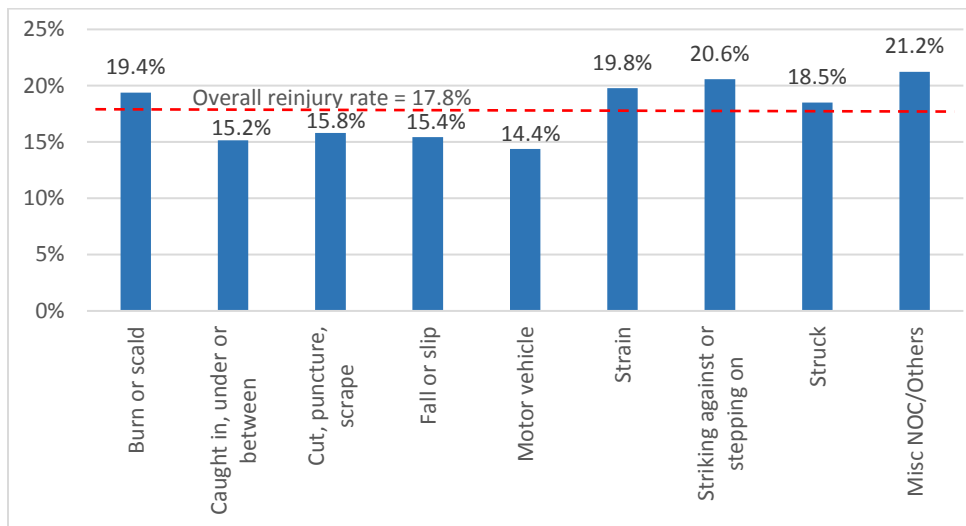
Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

However, while the rate of having a second injury in the same body part of the first injury was significantly higher than predictable, second injuries still occurred in different body parts in substantial numbers. For example, 74 percent of the claims with first back injury had a second injury in body parts other than back. This implies that second injuries occurred in the same body part of the first injury in a substantially high number of cases, but the majority of second injuries occurred in other body areas than the body part of the first injury.

Reinjury Rates by Cause of Injury

Cause of injury information was available for about 396,000 first injury claims from 2006 to 2013 injury years. Of these, 17.8 percent had second injuries (see Figure 7). “Fall or slip” injuries were slightly more common among single injury claims while “strain” injuries were more common among multiple injury claims. Reinjury rates were also higher among “strike” and “burn” injuries. “Vehicle” and “cut” injuries had lower reinjury rates, possibly because these were more severe injuries. As seen earlier, lost time claims with severe injuries tended to have lower reinjury rates for various reasons.

Figure 7: Reinjury rates by cause of injury, 2006–2013



Note: NOC = not otherwise classified

Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

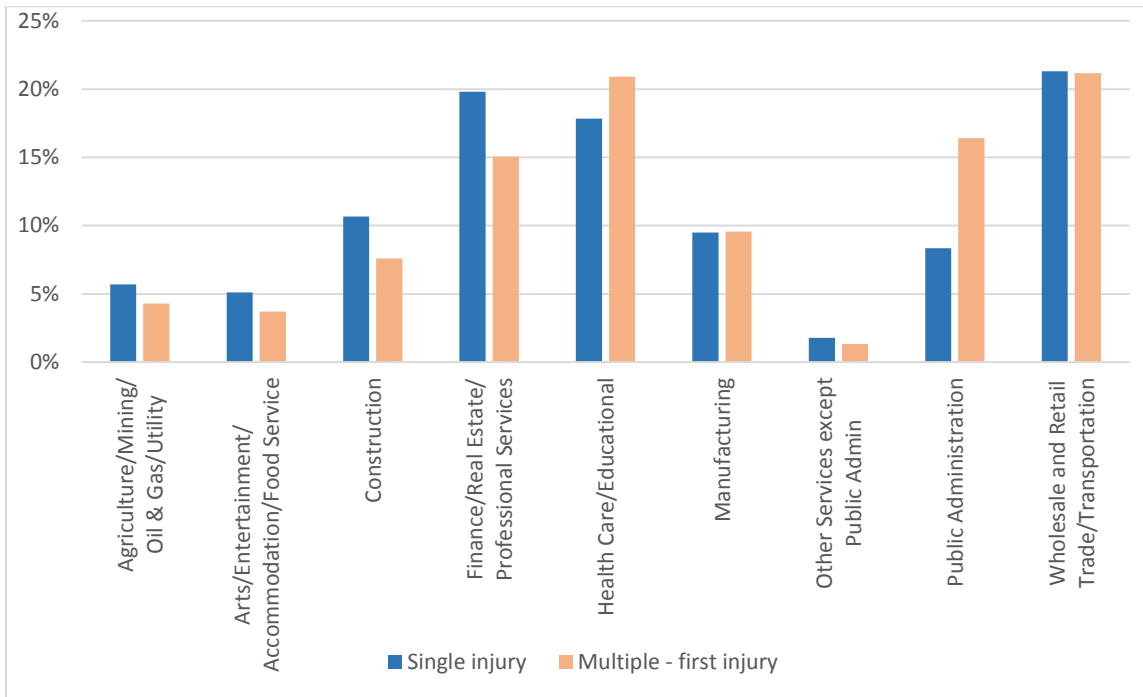
Reinjury Rates by Industry

Grouping employers by industry is based on the employer’s North American Industrial Classification System (NAICS) code. Unfortunately, neither medical nor claims data contain complete NAICS information. We have utilized unemployment insurance (UI) wage data from the Texas Workforce Commission. However, this data requires employers’ federal employer identification numbers (FEINs). Claims data in the Division of Workers’ Compensation of the Texas Department of Insurance (DWC) has employers’ FEIN information but this table is limited to injured employees with at least one day of lost time, which means that medical-only claims with no lost time have to be excluded from analysis. For that reason, slightly more than half of all claims were excluded from this analysis by industry.

In addition, only about 80 percent of the FEINs in the claims data are matched with FEINs in the UI wage data. Because of the nature of UI wage data, some companies and organizations (such as nonprofits) that have workers’ compensation may not report UI wages or may report UI wages under a different FEIN. As a result, 336,000 claims were analyzed for industry statistics compared to about 950,000 claims analyzed for injury type.

Based on the numbers of single injury claims and multiple injury claims from IY 2006 to IY 2013, Figure 8 shows percentage shares by industry. For both single injury and multiple injury cases, the Retail/Transportation/Warehousing sector had the highest share of claims. Single injury cases were relatively less common than multiple-injury cases in Public Administration, and Health Care/Educational Services industries while they were more common in Construction, and Finance/Real Estate/Professional Services industries.

Figure 8: Shares of injured employees by industry, first injury, 2006–2013

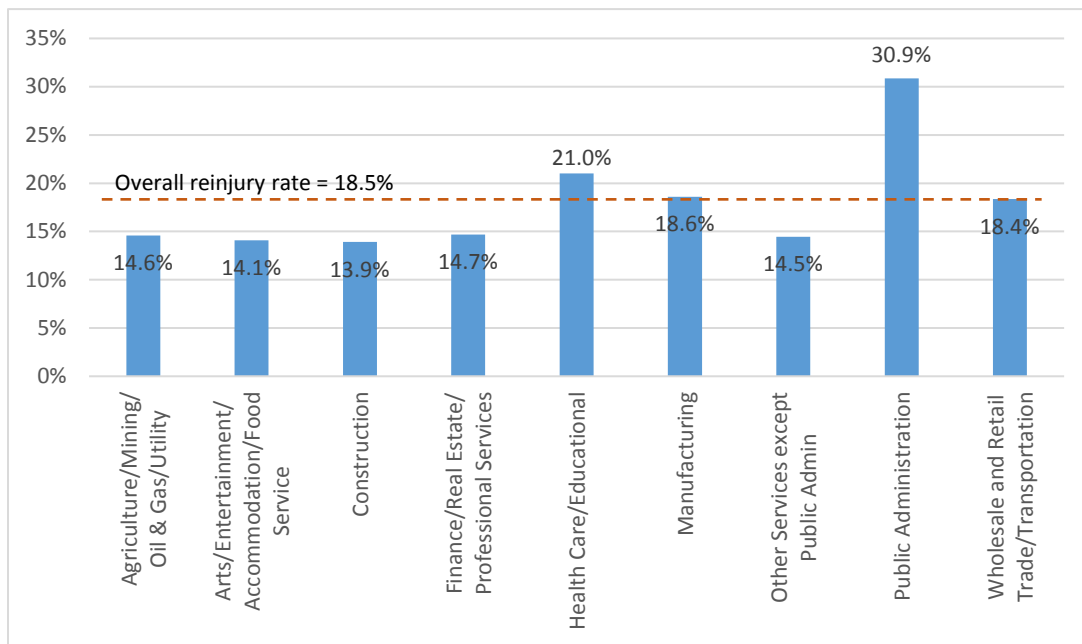


Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

The reinjury rate was highest in the Public Administration industry at 30.9 percent (see Figure 9). Interestingly, the reinjury rate was lowest for the Construction industry, which may be due to its lower share of medical only claims. The higher reinjury rate in the Public Administration industry was not a result of a higher share of medical only claims (with lost time of one to seven days). The overall share of medical only claims (in this database with NAICS information) was 32 percent while that share for the Public Administration industry was lower at 27.6 percent.

In addition, data caveats discussed above apply here. Claims data used for the industry analysis consists mostly of claims with lost time greater than seven days, and therefore with income benefits. High reinjury rates in Public Administration and Health Care/Educational Services industries may be an indication of an increased level of multiple injuries in these industries, or they may be influenced by other factors such as better FEIN, NAICS, or injury reporting practices in these industries. Because of the low availability of NAICS data, we cannot assess the impact of these factors.

Figure 9: Reinjury rate by industry, 2006–2013



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

Multiple Injuries and Multiple Employers

For about a third (34 percent) of injured employees with multiple injuries, the employer at the time of second injury was different from the first injury’s employer (see Table 4).¹³ This means that about two thirds of injured employees with multiple injuries were working for the same employer and possibly under the same insurer’s workers’ compensation coverage. However, this result is based on about 30,000 injured employees for whom we have identifiable employer data for both first and second injuries. A more complete database is necessary for any further analysis.

Table 4: Employer change status at second injury, by injury year

Employer status at second injury	2006	2007	2008	2009	2010	2011	2012	2013	Total
Same employer as first	2,860	2,829	2,817	2,675	2,576	2,442	2,242	2,021	20,462
Different employer	1,639	1,609	1,392	1,198	1,161	1,295	1,126	990	10,410
Total	4,499	4,438	4,209	3,873	3,737	3,737	3,368	3,011	30,872
Rate with different employer for second injury	36.4%	36.3%	33.1%	30.9%	31.1%	34.7%	33.4%	32.9%	33.7%

Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

¹³ Employers were identified by federal employer identification numbers (FEINs). In some cases, some of the different FEINs may be the same employers but the available data did not allow us to adjust for those instances. Nevertheless, our results may not be too anomalous. Ruseckaite and Collie’s study of Victoria, Australia, *op. cit.*, found that 34.4 percent of multiple injury claims worked for different employers for first and second claims.

If we are to consider employers' industries, the data constraint further reduced the number of observations to about 26,000. Within this data, the Public Administration industry had the lowest rate of employer change at 11.9 percent (see Table 5). While injured employees in the Public Administration and Health Care/Educational Services industries had the lowest rate of employer change, incidentally, they also had the highest reinjury rates.

Table 5: Employer change status by industry type, 2006–2013

Industry at first injury	Same employer as first injury	Different employer	Total	Rate of employer change
Agriculture/Mining/Oil/Utility	676	497	1,173	42.4%
Arts/Enter/Accommodation/Food	462	361	823	43.9%
Construction	1,119	930	2,049	45.4%
Fin/Real Estate/Prof Services	1,790	2,050	3,840	53.4%
Health Care/Educational services	4,253	896	5,149	17.4%
Manufacturing	1,504	795	2,299	34.6%
Other Services except Public admin	221	118	339	34.8%
Public Administration	4,248	572	4,820	11.9%
W/R Trade/Transport	3,956	1,820	5,776	31.5%

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Reinjury Rates by Network Status

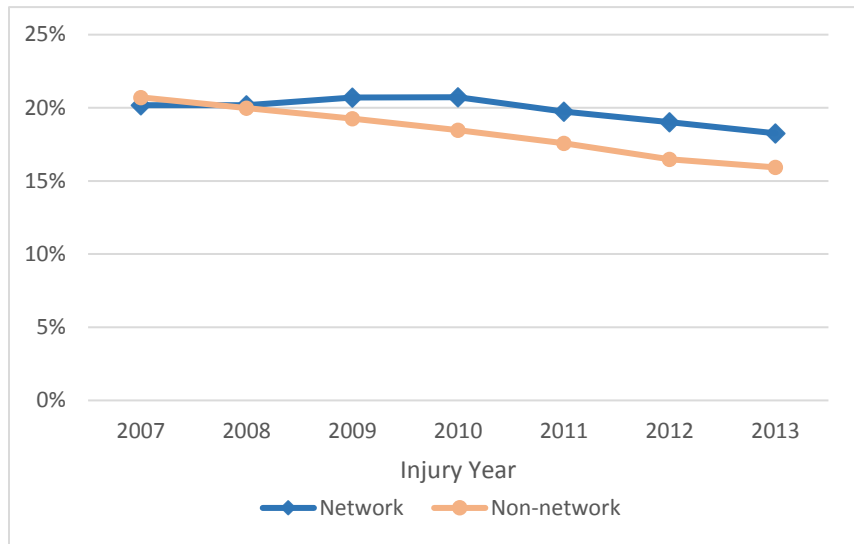
An employer may elect to use an insurance carrier's certified Workers' Compensation Health Care Network to provide health care services to injured employees. These networks are certified and regulated by the Texas Department of Insurance.¹⁴ Certification began in 2006 and, currently in 2017, about half of the newly-injured employees in the Texas workers' compensation system are treated by networks.

Reinjury rates were higher among injured employees treated by networks than non-networks (see Figure 10). For 2013 claims, the reinjury rate for network claims was 18.3 percent compared to 15.9 percent for non-network claims.

In previous analyses, it was shown that higher reinjury rates were associated with medical-only claim type, shoulder injury type, and the industry sectors of Public Administration and Health Care/Educational Services. But networks' higher reinjury rate was not explained by these factors. Networks had a higher share of lost-time claims (see Figure 11). The share of shoulder injuries was similar in network and non-network claims (see Figure 12). Clearly, other factors may be affecting network claims.

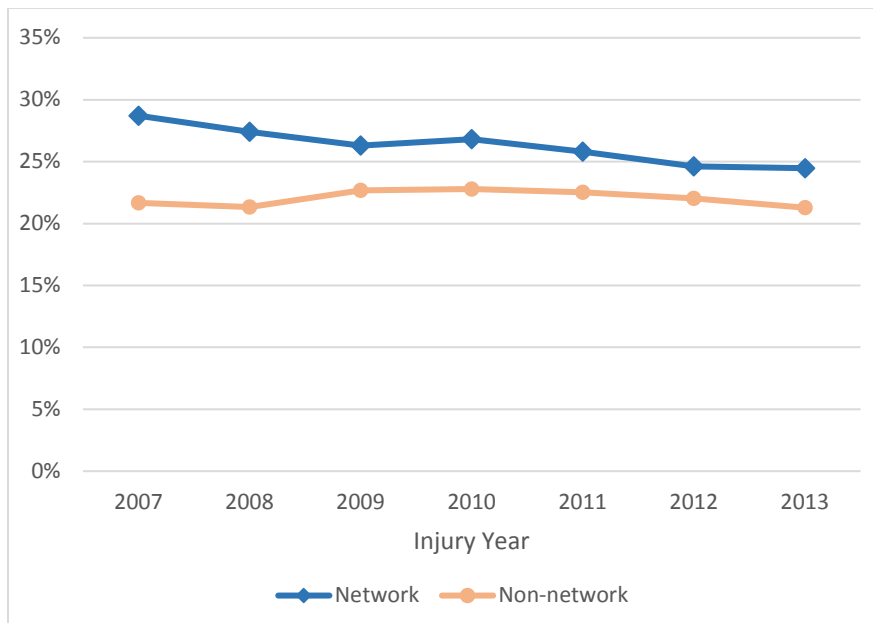
¹⁴ More information on the workers' compensation health care networks is available at TDI's website: <http://www.tdi.texas.gov/wc/wcnet/indexwcnet.html>

Figure 10: Reinjury rates by network status



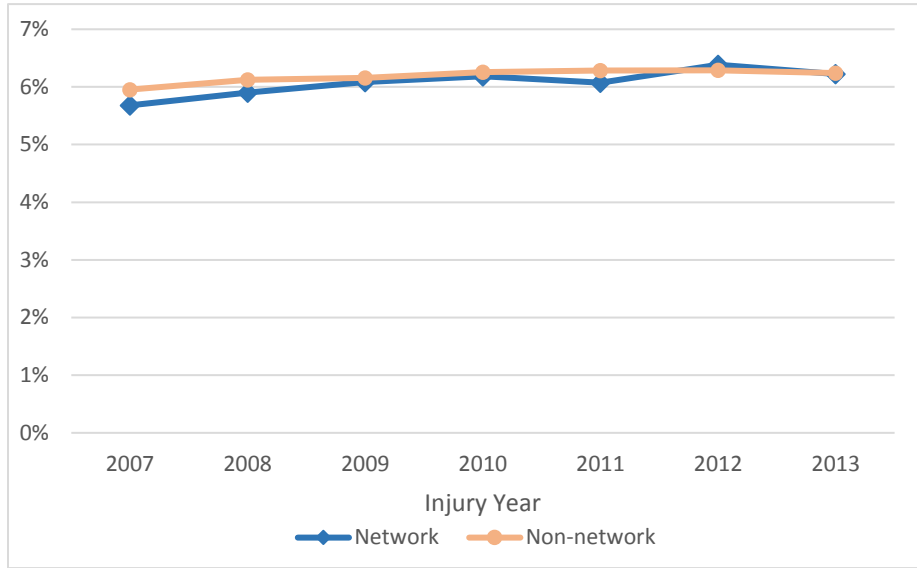
Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Figure 11: Share of lost-time claims by network status



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Figure 12: Share of claims with shoulder injury type by network status



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

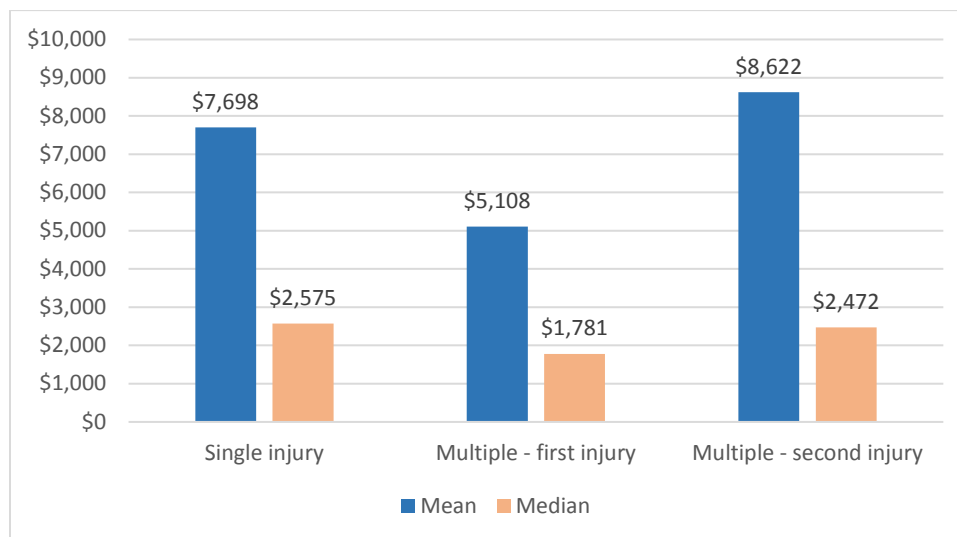
4. Benefits, Costs and Service Utilization by Reinjury Status

Temporary Income Benefits (TIBs)

If a work-related injury or illness causes an injured employee to lose all or some of his/her wages for more than seven days, an injured employee is provided with Temporary Income Benefits (TIBs).¹⁵ The average TIBs payments for the first injury among multiple injury claims (\$5,108) was 34 percent lower than that of single injury claims (\$7,698) (see Figure 13). But the sum of first and second injury costs of multiple injury claims (\$13,730) was 78 percent higher than the average cost of single injury claims.

Within multiple injury claims, the average benefits amount associated with first injury was lower than that of the second injury.¹⁶ This pattern is similar to the pattern found in medical costs discussed later in this section.

Figure 13: Average TIB benefit amounts by reinjury status, 2006–2012



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

This analysis covers injured employees whose first injury occurred between 2006 and 2012, and with benefits and costs considered for 12 months of services after the injury. The second injury may be in any year between 2006 and 2016. For the injury year 2016, some of the TIBs recipients may continue to receive benefits beyond 2017 which may not have been reported to DWC as yet. For this reason, the

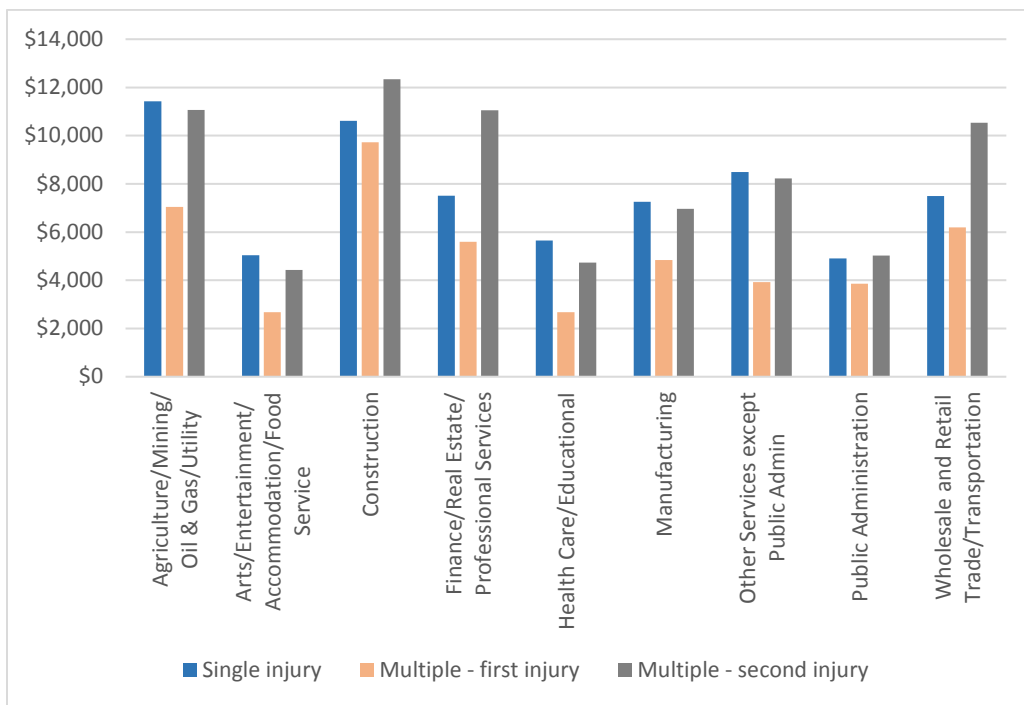
¹⁵ For more information about TIBs, visit TDI's website at <http://www.tdi.texas.gov/wc/employee/tempben.html>.

¹⁶ Similar income benefits and cost patterns are seen in Ruseckaite and Collie's "Repeat worker's compensation claims", *op. cit.*, which reported that income benefits and medical costs for the first injury of multiple injury claims were much lower than those of initial claims of single injury claims (50.1 percent and 59.0 percent lower for income benefits and medical costs, respectively). Costs for the second injury of multiple injury claims were much higher than those for single injury claims, 185.2 percent and 142.5 percent higher for income benefits and medical costs, respectively.

income benefit amount for ‘multiple – second injury’ claims may still be higher than presented in Figure 13.

In terms of industry, the average TIBs amount was relatively smaller in Public Administration, and Health Care/Educational Services industries where reinjury rates were comparatively higher (see Figure 14). Public sector injured employees are allowed to use their paid sick and vacation days in lieu of workers’ compensation income benefits. This may contribute to their lower durations and therefore lower income benefits costs. On the other hand, income benefit costs were comparatively higher in Construction, Agriculture/Mining/Oil & Gas/Utility, and Finance/Real Estate/Professional Services industries where reinjury rates were lower.

Figure 14: Average TIB benefits by industry, 2006–2012



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

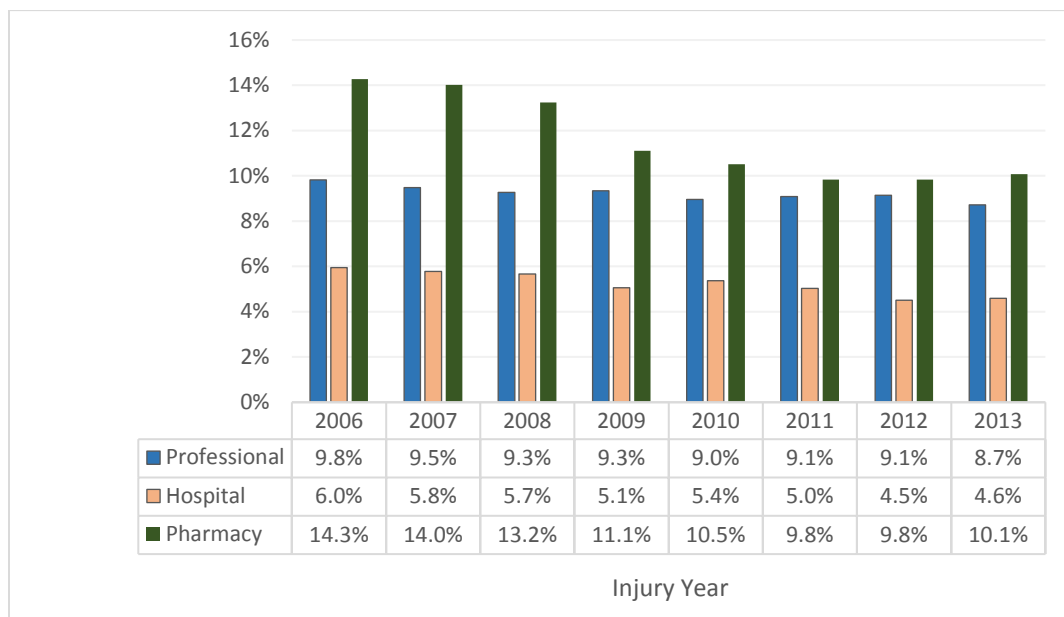
Higher TIBs amounts can also be interpreted as longer disability durations due to more severe injuries. Thus, probably due to the reason cited above, Public Administration claims may be perceived as having less severe injuries and shorter disability durations, while having higher reinjury rates, than claims in the Construction industry.

Overlapping Services

Overlapping services refer to cases where services and payments for the first injury claim were occurring after the second injury date. These cases indicate that medical and pharmaceutical benefits may be provided to the same injured employee from two separate claims at the same time.¹⁷

Among IY 2006 injured employees (with multiple injuries), 9.8 percent of them had overlapping professional services (see Figure 15). Overlapping service rates were higher in pharmacy services, at 14.3 percent of the injured employees for 2006 claims and 10.1 percent for 2013 claims. Overlapping service rates in pharmacy services decreased in recent years. Given the timeframe for second injuries and the pharmacy closed formulary of 2011, the decrease may be associated with the implementation of the pharmacy formulary. Overlapping service rates were about five percent for hospital services.

Figure 15: Share of injured employees with overlapping services by bill type, multiple injury claims



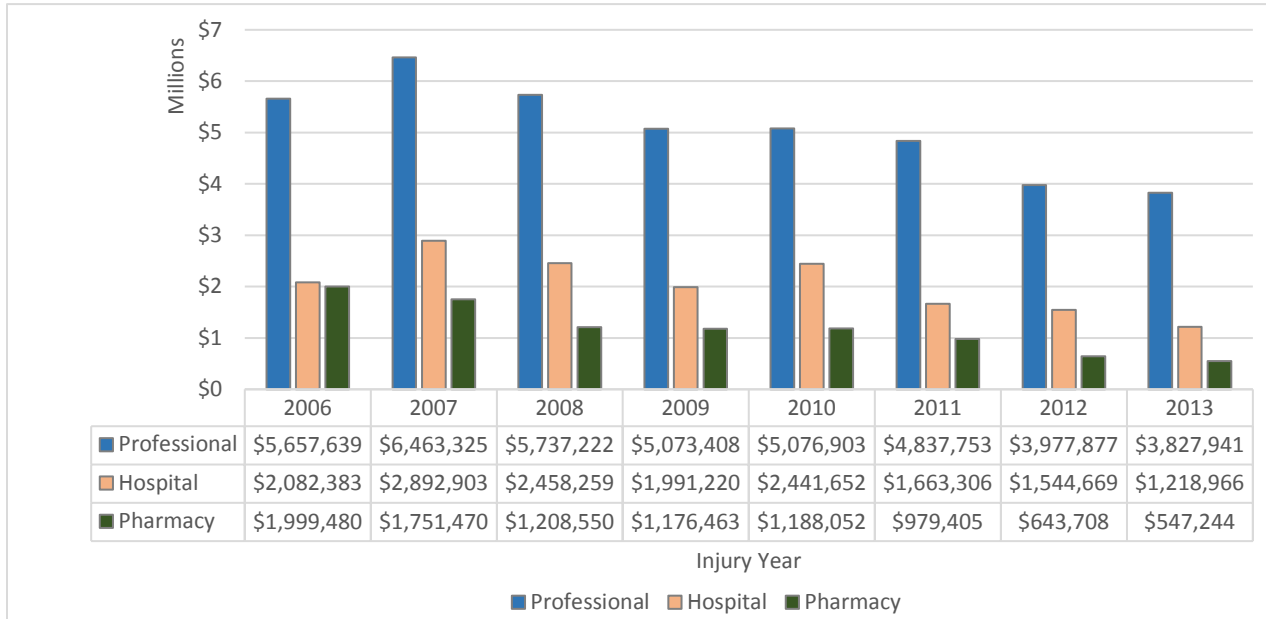
Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

In terms of cost, for 2006 claims, overlapping services (of the first injury claim) amounted to about \$5.7 million for professional services, and about \$2 million each for hospital and pharmacy services (see Figure 16).¹⁸ Overlapping services costs decreased steadily in recent years as the number of overlapping cases decreased and various reform measures such as medical fee guidelines and the pharmacy closed formulary were implemented by DWC.

¹⁷ For computational simplicity, the second injury date was used instead of the first service date for the second injury. In the majority of cases, these two dates were the same.

¹⁸ Although costs are presented by injury year of the first injury, actual service years for overlapping services may be any of the five years following the first injury. Cost trends by year should be interpreted as such.

Figure 16: Costs of overlapping services by bill type, multiple injury claims



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Professional Service Utilization and Costs

In professional services, first-injury services for injured employees with multiple injuries had the lowest utilization level (see Table 6). This may be related to the fact that multiple injury claims had a higher share of medical-only, less severe claims. The difference between single and multiple injury claims was more prominent in the frequency (number of visits) of utilization than in the intensity (services per visit).

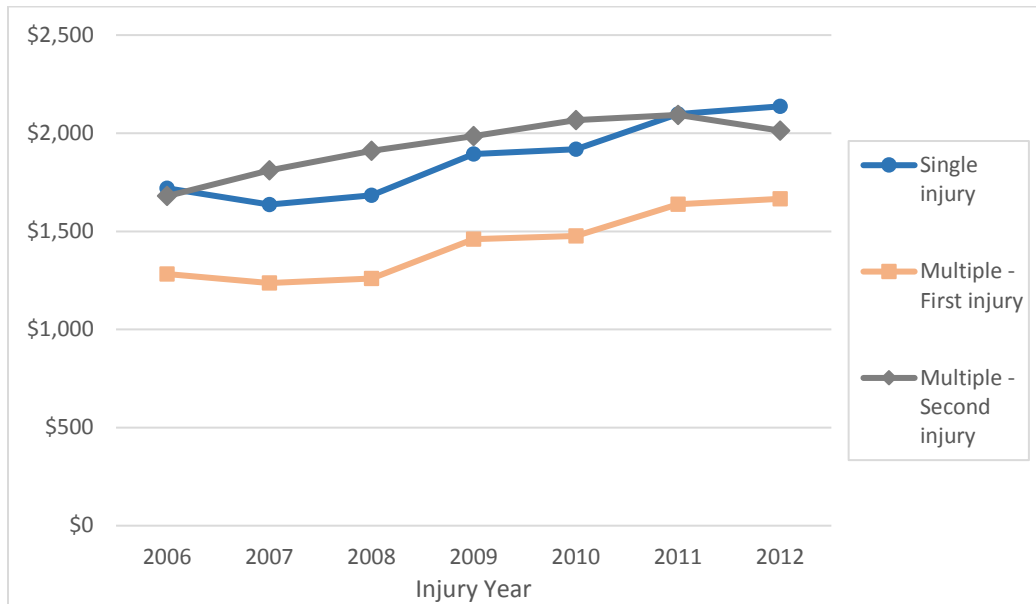
Table 6: Number of visits and services per visit per claim, professional services, by injury year

Claim type	2006	2007	2008	2009	2010	2011	2012
Number of visits per claim (Frequency)							
Single injury	9.4	8.7	8.5	9.0	8.8	8.6	8.6
Multiple - first injury	7.8	7.4	7.2	7.6	7.4	7.4	7.4
Multiple - second injury	9.0	9.1	9.0	9.0	8.9	9.0	8.7
Number of services per visit (Intensity)							
Single injury	3.4	3.3	3.3	3.2	3.2	3.1	3.1
Multiple - first injury	3.3	3.2	3.2	3.1	3.0	3.1	3.1
Multiple - second injury	3.3	3.2	3.2	3.1	3.2	3.2	3.2
Total number of services per claim							
Single injury	31.7	29.2	27.9	28.5	27.8	27.1	26.7
Multiple - first injury	25.7	23.9	23.1	23.6	22.7	22.8	22.6
Multiple - second injury	29.6	29.5	28.6	28.0	28.3	28.7	28.3

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

The average professional service cost per claim (within the first 12 months after injury) was highest for the second injury of the injured employees with multiple injuries (see Figure 17).¹⁹

Figure 17: Average cost per claim, professional services with 12 months of service



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

The shares of claims receiving a particular professional service are not much different between single injury claims and multiple injury claims (see Table 7). Single injury claims tended to have comparatively higher utilization in surgery services, while multiple injury claims had a higher utilization in impairment rating examination and report services. Utilization in all other services was quite similar for the two claim groups.

Table 7: Percentage of claims utilizing professional services, 2006–2012

Service group	Single injury claims	Multiple injury claims (first injury)
DMEPOS	47.1%	46.6%
Diagnostic/Pathology/Laboratory	65.0%	63.8%
Evaluation/Management	95.3%	95.9%
IR Exam & Report	70.4%	73.0%
Other Services	30.7%	28.3%
Physical Medicine	27.3%	27.1%
Surgery - Other	28.9%	24.1%
Surgery - Spinal	1.4%	0.8%

Note: DMEPOS = durable medical equipment, prosthetics, orthotics and supplies; IR = impairment rating.

Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

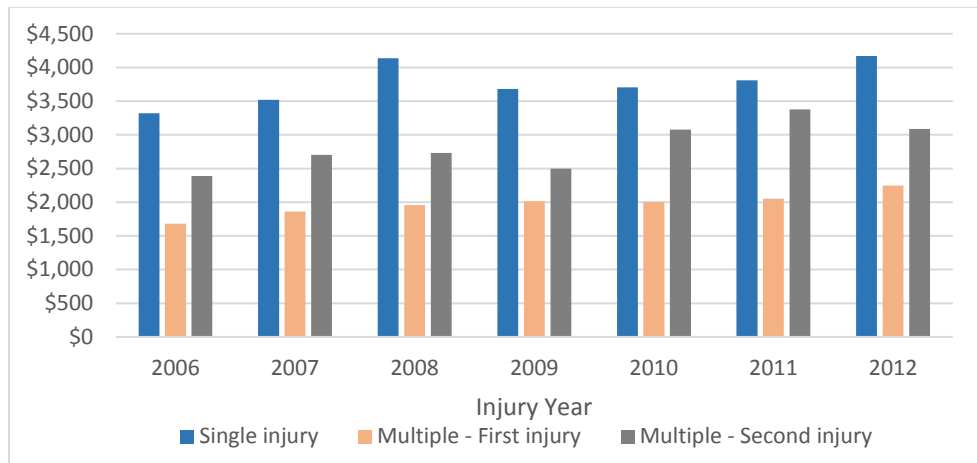
¹⁹ Some of the second injuries of 2012 claims occurred in 2016 and their services and costs in 2017 may not have been fully reported. This partially explains the decrease in the average cost of ‘multiple-second injury’ group for IY 2012.

Hospital Service Costs and Utilization

Hospital costs had a pattern notably different from professional service costs in that the cost for single injury claims was much higher than either multiple-first or multiple-second claim costs (see Figure 18). This may be a reflection of the fact that single injury claims had a higher share of lost time claims with severe injuries than multiple injury claims. Hospital utilization rate was also highest among single injury claims and the lowest among the second injury of multiple injury claims (see Figure 19).

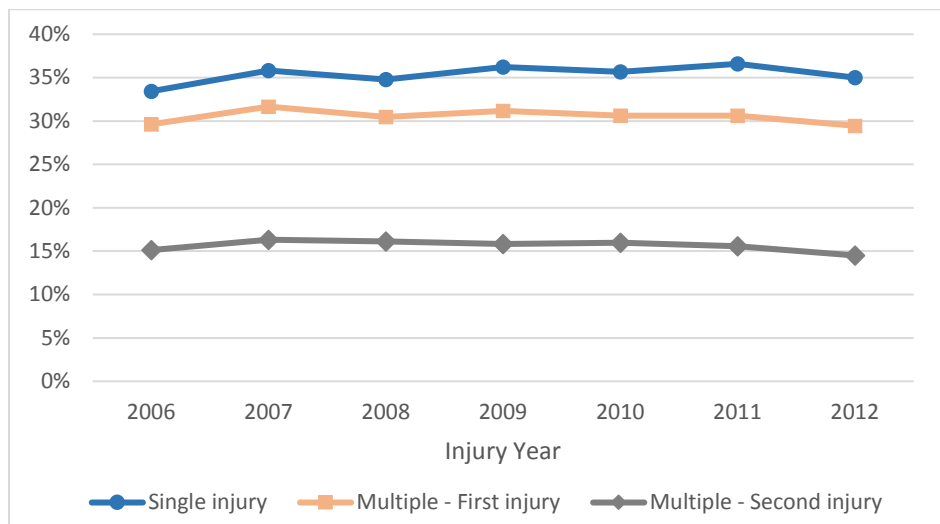
Still, the total cost of multiple injury claims (the sum of costs for first and second claims) was higher than the single injury claim cost, by about 30 percent. This compares to the difference of more than 70 percent seen in TIBs income benefits and professional costs.

Figure 18: Average cost per claim, Hospital services



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Figure 19: Hospital service utilization: percent of claims receiving hospital services



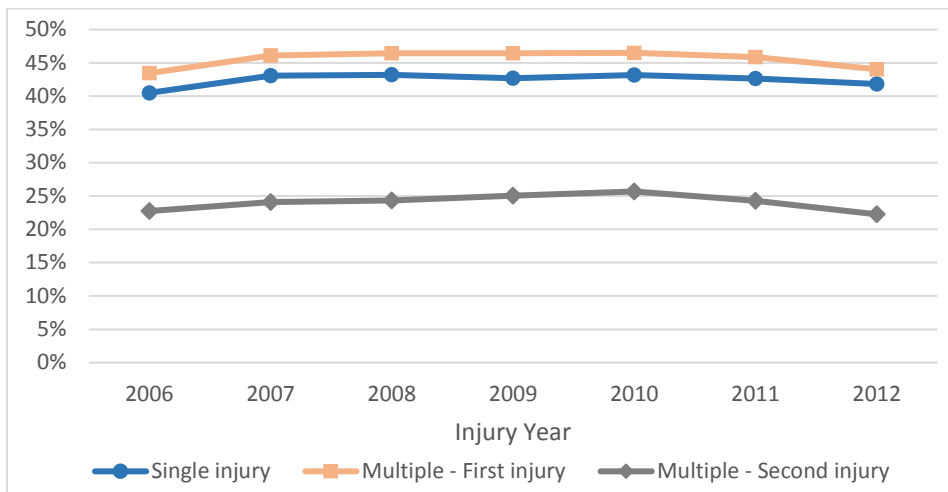
Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

5. Pharmacy Services and Multiple Injuries

Pharmacy Costs and Utilization

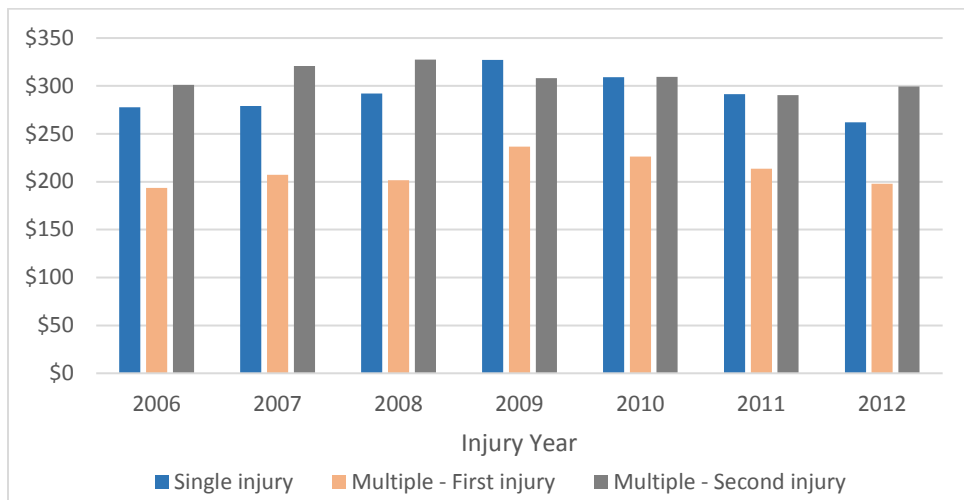
Between 40 percent and 45 percent of both single injury and multiple injury claims received pharmacy services for the first injury claim (see Figure 20). Utilization was slightly higher for multiple injury claims, but their pharmacy utilization for the second injury was much lower.²⁰ However, the average pharmacy cost was highest for the second injury of multiple injury claims (see Figure 21).

Figure 20: Percent of claims receiving pharmacy services, 12 months of services



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Figure 21: Average pharmacy cost per claim, 12 months of services



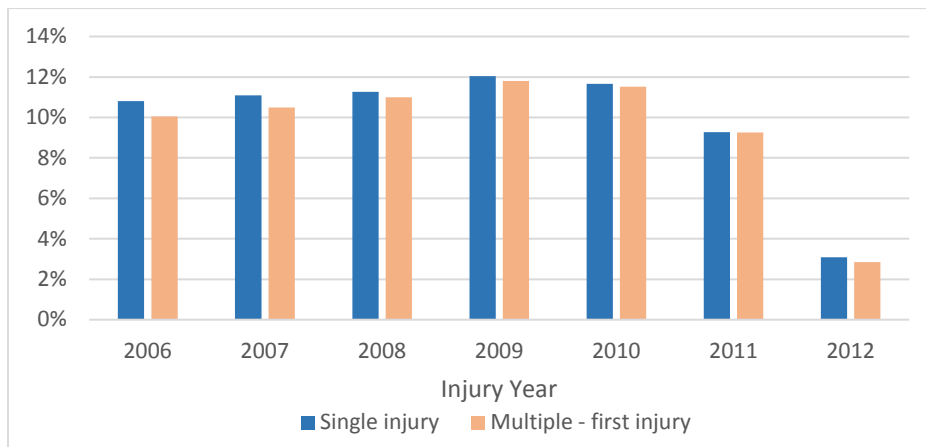
Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

²⁰ The majority of pharmacy costs occur in the later years of service. This report considered the first 12 months of service after injury because of the timeframe issue, and it may be too restrictive to fully evaluate pharmacy costs.

Pharmacy Closed Formulary and “N” Drug Usage

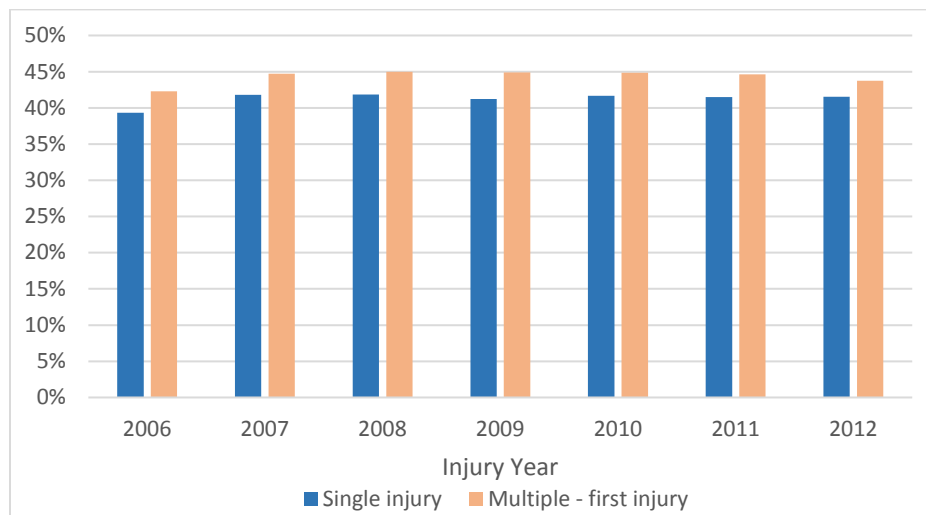
From September 1, 2011 (Injury Year 2012), all new claims have been subject to the pharmacy closed formulary rule that requires preauthorization for drugs identified with a status of "N" in the current edition of the Official Disability Guidelines (ODG), any compound that contains a drug identified with a status of "N", and any investigational or experimental drug. The share of claims receiving “N” drugs decreased significantly since the formulary, from over 10 percent of the claims before 2010 to about three percent in 2012 (see Figure 22). This decrease occurred similarly in both single injury and multiple injury claims. On the other hand, “Other” drugs (non-N drugs) were not significantly affected by the formulary, at least in IY 2012 (see Figure 23). Note that second injuries of multiple injury claims are not comparable because second injuries may have occurred before or after the formulary.

Figure 22: Percentage of claims receiving “N” drugs



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

Figure 23: Percentage of claims receiving “Other” drugs



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

Pharmacy Utilization by Drug Group

Single injury claims tended to receive a significantly higher rate of central nervous system (CNS) drugs (such as anticonvulsants and antidepressants) compared to multiple injury claims, and slightly more opioids than multiple injury claims, perhaps because single injury claims had more severe injuries (see Table 8). On the other hand, claims with multiple injuries received NSAIDs and musculoskeletal drugs more often than single injury claims.

Table 8: Percentage of claims receiving prescriptions by drug group, by injury year

	2006	2007	2008	2009	2010	2011	2012
NSAIDs							
Single injury	23.9%	25.3%	25.7%	25.5%	26.0%	25.3%	24.6%
Multiple – first injury	27.0%	28.8%	29.1%	29.2%	29.1%	28.9%	27.3%
Opioids							
Single injury	23.0%	24.4%	24.2%	24.0%	23.9%	24.1%	23.6%
Multiple – first injury	22.0%	23.8%	23.5%	23.3%	23.3%	23.5%	22.5%
Central nervous system drugs							
Single injury	4.1%	4.0%	3.7%	3.7%	3.6%	3.4%	3.0%
Multiple – first injury	2.9%	3.0%	2.6%	2.5%	2.5%	2.5%	2.0%
Musculoskeletal drugs							
Single injury	12.8%	13.4%	13.6%	13.7%	14.1%	13.9%	13.3%
Multiple – first injury	13.6%	14.4%	14.8%	15.3%	15.7%	15.1%	15.0%

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018

Opioids and Multiple Injury Status

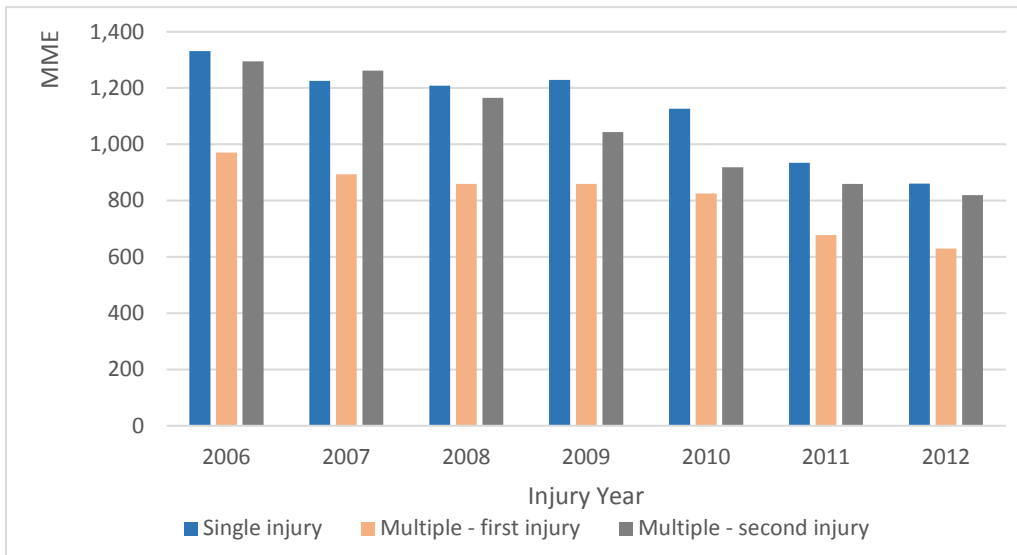
To make various prescription strengths and packaging comparable, opioid prescriptions were converted to morphine milligram equivalents (MMEs) using guidelines published by the Prescription Drug Monitoring Program Training and Technical Assistance Center (PDMP TTAC) at Brandeis University.²¹

Summing up all opioid prescriptions per claim, Figure 24 shows the total MMEs per claim for an average claim. Similar to other cost and utilization metrics, a relatively low level of opioids was used in multiple – first injury cases.

The overall level of opioids decreased consistently over the years. For single injury claims, the total MMEs per claim decreased from 1,331 MMEs in 2006 to 860 MMEs in 2012, a 35 percent decrease. For first injury cases of multiple injury claims, the rate of decrease was similar at 34 percent (from 971 MMEs in 2006 to 638 MMEs in 2012). This decrease was accelerating in 2011 and 2012. Injury year 2012 was the first year of the pharmacy closed formulary for new claims. Opioid utilization in the second injury for multiple injury cases may or may not include post-formulary years, and may be affected by the reclassification of hydrocodone combination products as a Schedule II controlled substances in 2014.

²¹ For more information, see <http://www.pdmpassist.org/>.

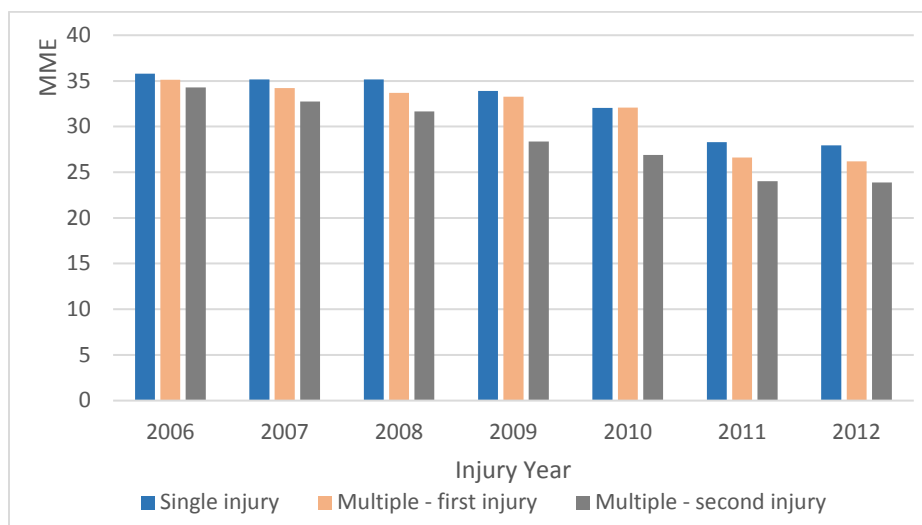
Figure 24: Opioid utilization by average total MMEs per claim, 12 months post-injury



Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018

Since the total dose of opioid prescriptions may be dispensed over varying numbers of prescription days, a more comparable measurement is the average daily dose. Daily MMEs per claim were calculated by adjusting for the total number of prescription days. The difference in daily doses between single injury claims and multiple injury claims (for first injury) was minor (see Figure 25) although the difference increased slightly in 2011 and 2012.

Figure 25: Average daily MMEs per claim

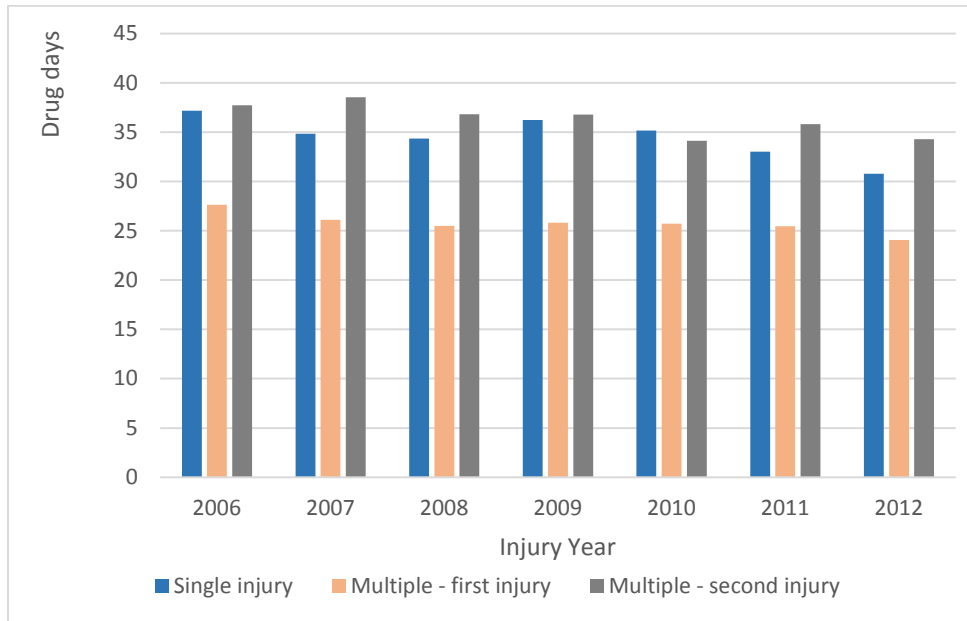


Source: Texas Department of Insurance, Workers’ Compensation Research and Evaluation Group, 2018.

The average daily doses of opioids were shown to be similar across claim groups, but the number of days prescribed for opioids differed significantly between single and multiple injury claims (see Figure 26). The number of days for multiple – second injury group was relatively higher even though the

average daily dose was lower for this group (as seen in Figure 25). Consequently, the pattern of total opioid doses (in Figure 24) was similar to that of drug days. This indicates that opioid utilization patterns varied more by the length of drug days than by the intensity or drug doses per day.

Figure 26: Average number of days prescribed for opioids per claim



Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

6. Estimating Risks of Multiple Injuries

In previous sections, we presented observational characteristics of single and multiple injury claims in relation to having a second injury. In this section, we present a more quantitative analysis of the effects of various factors on reinjury. Stepwise logistic regressions were used to estimate the effects of some factors on the likelihood of having a second injury. The response variable was whether one had a second injury within four years of the first injury. The total number of cases was 287,887 injured employees, with 234,684 cases of single injury and 53,203 cases that had two injuries. The dataset consisted of claims with at least one day of lost time, including both lost time claims with income benefits and medical only claims without income benefits.²² Seven variables were chosen as predicting factors:

- Injury years of 2012 and 2013, representing post-formulary years;
- Claim type, whether the first injury claim was a medical only claim;
- Injury type, whether the first injury was a shoulder injury;
- Gender, whether the employee was male;
- Age at first injury, an interval variable;
- Industry type, whether the employer was in the public administration industry; and
- Network status, whether one was in the workers' compensation health care network.

The result of the logistic regression is shown in Table 9. Likelihood ratio chi-square test was used to test the model's goodness of fit, which showed that the selected variables above were significantly more reliable than a model with intercept only. Test statistics for parameter estimates are shown in the table. All estimates are statistically significant.

Table 9: Analysis of maximum likelihood estimates

Factors	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
IY 2012/2013 (post-formulary)	1	-0.1853	0.0119	243.2217	<.0001
Claim type (medical only)	1	0.1099	0.0103	113.6234	<.0001
Gender (male)	1	0.0576	0.0103	31.5163	<.0001
Age	1	-0.00571	0.000368	240.8888	<.0001
Injury type (shoulder)	1	0.1541	0.0175	77.3386	<.0001
Industry (public administration)	1	0.7763	0.0139	3097.5602	<.0001
Network	1	0.025	0.0109	5.281	0.0216

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

²² This regression was conducted with a database of "reportable" claims with at least one day of lost time because this database contained industry information and more complete demographic information than medical billing data. Therefore, "medical only" claims in this analysis are those with one to seven days of lost time with no income benefits. "Lost time" claims are those with more than 7 days of lost time with income benefits. Medical only claims accounted for 68 percent of the total cases in this dataset. Medical only claims without any lost time were not contained in the database.

The calculated odds ratios are shown in Table 10. An odds ratio of one implies an even likelihood of an event occurring. If an odds ratio is greater than one, it implies a higher likelihood of having the event (a second injury) occurring. An odds ratio of less than one implies a lower likelihood of a second injury. For example, claims in the post-formulary years had a lower odds of having a second injury compared to pre-formulary year claims because the odds ratio (0.831) for the former group is less than one. Medical only claims, with an odds ratio of 1.116, were slightly more likely to have a second injury than lost time claims.

Table 10: Odds ratio estimates at 95% confidence interval

Factors	Point Estimate	95% Wald Confidence Limits	
IY 2012/2013 (post-formulary)	0.831	0.812	0.85
Claim type (medical only)	1.116	1.094	1.139
Gender (male)	1.059	1.038	1.081
Age	0.994	0.994	0.995
Injury type (shoulder)	1.167	1.127	1.207
Industry (public administration)	2.173	2.115	2.234
Network	1.025	1.004	1.047

Source: Texas Department of Insurance, Workers' Compensation Research and Evaluation Group, 2018.

The estimated odds ratios show that males and younger injured employees had a slightly higher odds of having a second injury.²³ For the age variable, the estimate is for one year of age: a one year increase in the age slightly lowers the odds of a second injury (0.994). Employees in the public administration industry were more than twice more likely to have a second injury compared to employees in all other industries (with an odds ratio of 2.173). The effect of being in a workers' compensation health care network was slightly positive on having a second injury but the odds ratio estimate was very close to one (point estimate of 1.025 and its lower confidence limit of 1.004) which implies that the effect of network participation may be negligible.

In summary, the regression results were generally consistent with the evidences examined in previous sections. Type of industry (where employees work) and body location of injury of the first injury were highly and significantly associated with a higher odds of having a second injury.²⁴ Also, the reinjury rate was significantly lower for the claims in the post-formulary years. But the decline in the reinjury rate was continuous and consistent from 2006 till 2013, and thus it may be inaccurate to associate the lower reinjury rate with the formulary. Other factors such as age, gender, and network status were statistically significant, but estimated effects were relatively minor. For demographic and employer characteristics, the most significant issue was a lack of available and usable data.

²³ Similarly, Cherry et al. "Second WCB claims", *op. cit.*, p. S54, reported that males and younger employees were more likely to have a second claim. The lower rate of reinjury among older employees was attributed, in part, to a potential bias because of a shorter time horizon for reinjury in their study.

²⁴ However, this statistical association does not mean one causes the other. It simply indicates that multiple injury cases were more commonly observed in certain industries or injury types for various reasons. One possible explanation may be that, after the first injury, injured employees in the public administration industry continued to work longer than those in other industries, thereby having a higher "reported" instances of a second injury.

7. Summary and Concluding Remarks

Workers' compensation claims are distinguished by injury dates. When an injured employee suffers multiple injuries on different dates, the resulting claims are reported, managed and analyzed as separate cases or incidents. However, these multiple, repeated, or recurrent injuries of one employee affect the same individual, potentially resulting in medical and cost complications and other issues that have not been closely investigated. This report is a first attempt to present an overall assessment of the prevalence of multiple injuries or claims and the significance of various factors associated with multiple injuries.

The data indicated that about 40 percent of the claims in each injury year were claims by those individuals who had at least one previous injury. Furthermore, even among those without prior injuries, about 30 percent of them would have a second injury in about 10 years. Considering all claims since 1998, 53 percent of them were associated with individuals with multiple injuries.

The reinjury rate was notably higher for those in public administration and health care industries. It was also higher among medical only claims and those with shoulder injuries. Logistic regression analyses showed that the odds of having a second injury was also associated with male gender and younger age. Participation in health care networks was not a significant factor.

Medical and income benefit costs associated with the first injury of multiple injury cases were significantly lower than the costs of single injury employees. However, the total costs of first and second injuries of multiple injury employees were significantly higher than those of the single injury cases. Further research should assess whether and how repeated injuries can be reduced or prevented, but available data clearly showed that multiple injuries are quite common and costly, and that many injured employees sustain repeated injuries.

Evaluating the cause and effect and the exact process by which these factors affect reinjury will require more detailed studies with improved data. Current claim-centered data is extensive in medical costs, but data on income benefits and disability duration is often incomplete. In addition, employee data regarding demographic, employer, and industry characteristics are partial and limited. Results in this report should be viewed within these data limitations.



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