



Firefighter's Workers' Compensation Claims in Montana, 2007-2017: A Cost Analysis

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Abstract

The objective of this study was to examine costs associated with workers' compensation claims from firefighters in Montana. Workers' compensation claims data were obtained from the Montana Department of Labor and Industry. The highest proportion of total benefit amount dollars was paid to male firefighters (93.7%), public employees (84.8%), and those who were 45-54 years of age at time of injury (23.9%). Part-time employees represented the employment category receiving the highest total benefit amount (\$766,354). July represented the month with the highest average total benefit amount cost (\$52,084). Strains and sprains, back injuries, and lifting activities all represented the highest total benefit amount cost in terms of nature of injury, body part injured, and cause of injury, respectively. No statistically significant difference was found between the median total benefit costs in terms of gender, employment type, employment sector, or firefighting activity. Understanding the costs associated with workers' compensation claims can provide insight into injury severity and these results may aid in the development of more informed decisions for resource allocation and effective prevention strategies.

Keywords: Occupational Injuries; Occupational Illnesses; Total Benefit Amount; Injury Costs; Accident Prevention

Abbreviations

FROI: First Report of Injury; MSD: Musculoskeletal Disorder; NOC: Not Otherwise Classified; PPD: Permanent Partial Disability; PTD: Permanent Total Disability; PTSD: Post Traumatic Stress Disorder; SAS: Statistical Analysis System; SOII: Survey of Occupational Injuries and Illnesses; SROI: Subsequent Report of Injury; TPD: Temporary Partial Disability; TTD: Temporary Total Disability; WCAN: Workers' Compensation Administration Network.

Introduction

Firefighters are first responders who are exposed to high hazard conditions and events that can result in acute or chronic adverse health effects. The work of firefighters includes controlling and extinguishing fires and responding to other emergency situations that can present increased risks to life, property, or the environment [1]. According to the Bureau of Labor Statistics [1] there were 730 firefighters employed in the state of Montana in 2017. The concentration of firefighters is low relative to other states. The location quotient is computed by dividing the local area's employment concentration by the national average employment concentration [2]. Montana location quotient for firefighters is 0.71 which represents a reduced workforce concentration relative to the national average [1].

Despite the low number and concentration of firefighters in the state, Montana experiences a very high number of wildfires. The National Interagency Fire Center (n.d.) reported that in 2017 the state of Montana experienced a total of 2,422 wildfires that burned

1,366,498 acres, which placed the state eighth for total number of fires and first for total number of acres burned. The United States as a whole experienced a total of 71,499 wildfires with 10,026,086 acres lost to fire in 2017. Based on the national data of acres burned, Montana amounted to 13.6% of the total acres lost nationwide.

Firefighters may be exposed to hazardous job conditions although, not all required job duties are equally hazardous [3]. Firefighting activities may result in exposure to psychological, chemical, ergonomic, thermal, and physical hazards [4]. The fire service industry has higher non-fatal injury rates compared to other occupations in the United States [5]. According to the BLS [6], firefighters have a non-fatal injury rate about four times greater than other industries. According to Gray [7], multiple studies in the United States have demonstrated high injury rates among emergency responders that were above the national average.

Crisis situations create unusual circumstances that may hinder good ergonomic practices. Strenuous and dynamic movement, uneven terrain, high repetition, extreme reaches, heavy lifting, and pulling and pushing of heavy loads in the firefighting industry can lead to musculoskeletal disorders, most notably back injuries [8]. Firefighters often need to perform work tasks that place their bodies in awkward and extreme positions that may lead to strains and sprains of musculoskeletal structures. According to Walton *et al.*, [8] 1/3 of occupational injuries among firefighters result from overexertion. Firefighters may be required to work in unfamiliar areas which increases risk of injury due to unpredictability [7].

When a firefighter is injured or develops an illness as a result of work, a workers' compensation claim is usually filed. Workers' compensation provides for medical care to treat the injury or illness and wage replacement to support the injured worker until they return to their job [9]. If the injured firefighter does not return to work, they are evaluated for permanent disability and may be retrained to another lesser demanding type of work. Musculoskeletal disorders (MSDs) due to workplace injuries often result in ten to fourteen days away from work [10]. Days away from work then require other firefighters to step in and work overtime to accomplish the minimum amount of staffing required at each station [10]. According to McGinnis and Games [10], mandatory overtime without proper rest cycles can lead to higher risk of injury.

The primary goal of this study was to examine and disseminate the workers' compensation cost experience of firefighters in Montana. A secondary goal was to make cost comparisons between different dichotomous variables of interest. It was hypothesized that there would be a difference in median total benefit amount cost between specific firefighting focus (wildland vs. structural), employment type (part time vs. full time), employment sector (private vs public), and sex (male vs. female).

Evaluating total benefit costs of Montana firefighters from 2007-2017 may provide a deeper understanding of severity, financial impacts, and potential target areas for training improvement. Assessing the characteristics of claims that are associated with higher costs may inform resource allocation decisions and prevention strategies. Well-designed strategies that mitigate high-cost losses by reducing injuries and illnesses among firefighters will lessen the economic burden to communities, the state, and society as a whole.

Methods

Montana department of labor and industry report

The data used in this study were originally retrieved and analyzed for use and publication of a report completed for the Montana Department of Labor and Industry.

Brennan, J and Mutzenberger, R. [11]. Firefighters in Montana: Health and Safety Issues. Montana Worker Health. Montana Department of Labor and Industry. Available online at [http://erd.dli.mt.gov/Portals/54/Documents/Worker-Health/2018 FireFighter-Report-MOHSS-Accessible.pdf?ver=2018-11-21-081409-360&fbclid=IwAR3fwMUEePO9iEDGkbZWouaeQN9jjzEkDINlJqpXcjGr4x17mNDi6dpwIGE](http://erd.dli.mt.gov/Portals/54/Documents/Worker-Health/2018%20FireFighter-Report-MOHSS-Accessible.pdf?ver=2018-11-21-081409-360&fbclid=IwAR3fwMUEePO9iEDGkbZWouaeQN9jjzEkDINlJqpXcjGr4x17mNDi6dpwIGE)

Brennan and Mutzenberger [11] evaluated 1,989 workers' compensation claims from firefighters in Montana that occurred during various work activities, 82.5% of claims did not include wage loss and 17.5% of claims did include a wage loss. The current study examined only the 17.5% of claims that included wage loss.

Data acquisition

Worker compensation claims that were filed with the Department of Labor and Industry with dates of injury from January 1,

2007 to December 31, 2017 were obtained from the Workers' Compensation Administration Network (WCAN) database. The firefighter claims were selected by pulling specific occupational payroll class codes that were based on the NCCI Scopes Manual codes used in Montana. The codes include: 7704, 7710, 7711, and 7420. The codes represent Firefighters and Drivers (7704), Forest or Wildland Firefighting (7710), Volunteer Firefighters and Drivers (7711), and Aviation/Aerial Firefighting/Flying Crew (7420). The occupational code 7704 accounted for 97% of the evaluated claims. Claims by occupational codes were chosen rather than industry codes in order to capture as many firefighters claims across industries as possible.

All injuries with a First Report of Injury (FROI) filed and all injuries with a Subsequent Report of Injury (SROI) filed were pulled and the two datasets were combined so there was one entry for each claim. If the FROI was followed by a SROI for a specific claim, the claims were coded as a "wage loss" claim. All duplicate claims were removed. In order to de-identify the claims, the agency claim number and the claim ID number were deleted. A random ID number was assigned to each claim.

The dataset consisted of 1,989 total workers' compensation claims and 348 of the claims filed had a wage loss. For each wage loss claim, there was an estimated total benefit amount paid. SAS statistical software, version 9.4 (Cary, NC) was used to create six new variables from the data set. The created variables included total benefit amount paid, time worked, updated nature of injury, updated part of body, updated cause of injury, and service type. Total benefit amount paid was created by adding all categorized benefit payments together. Specifically, the total benefit amount was the sum of the permanent total disability (PTD), permanent partial disability (PPD), temporary total disability (TTD), temporary partial disability (TPD), vocational rehabilitation amount, and medical treatment costs. Time worked included the time between the date of injury and reported date of hire. Service type was used to categorize the activity that was taking place as described in the written accident description that resulted in the injury.

The term "structural" was used to classify firefighters who worked on structural fires. The term "wildland" was used to describe the actual fighting of a wildland fire. Emergency was used to categorize EMS and medical calls. Exercise/Training was used to categorize physical training/exercise not related to a call or actual fire. Other was used to categorize all other services which could include activities such as cleaning or snow removal. Other also included claims with some information written in the accident description but not enough in order to make a specific service type determination. Microsoft Excel was used to compute descriptive statistics and to create descriptive graphs.

Data analysis

The total benefit amount was evaluated against the following variables; employment status, age range, years of experience, month of claim, year of claim, nature of injury, body part injured,

cause of injury, employment type, activity type, gender, and county where injury occurred for descriptive presentation. As part of the descriptive analysis, the top five most expensive “nature of injury” were presented as well as the top five recorded “body part injured” and “cause of injury” because these accounted for the majority of the total claim cost in each category. A county map was developed to present the total benefit amount paid in counties experiencing costs from 2007-2017 across Montana.

Data from the 348 cases with a wage loss were also dichotomized by sex, employment type (full-time vs. part-time), employment sector (public vs. private), and firefighting focus (wildland vs. structural). A Wilcoxon rank-sum test (also known as a Mann-Whitney U test) was performed to compare the median of total benefit amount for each dichotomous variable. The null hypothesis was that there was no difference in medians for each comparison and the direction of any potential difference was not assumed in the research hypotheses. The assumption of homogenous distributions was assessed via a visual evaluation of histograms.

The data were analyzed using Minitab statistical software version 18 (State College, PA). All data acquisition and analysis was conducted according to a protocol approved by the University of Montana Institutional Review Board.

Results

A total of 348 Workers’ Compensation Claims identified by the Montana Department of Labor and Industry were associated with a wage loss in the firefighting industry. Of the 348 claims with wage loss, 326 (93.7%) of them were filed by males and 20 (5.7%) by females. Of the 348 claims, 52 (14.9%) had private industry listed as employment type, 295 (84.8%) were public, and one was state.

Firefighters in the public employment sector represented the highest amount of total benefit costs, \$6,755,828 over the years studied. Firefighters between 45-54 years of age had the highest total benefit amount, \$3,236,066 from 2007-2017.

Of the 348-wage loss claims evaluated, 24 were full-time employees, 37 were part-time employees, 4 were volunteers, 2 were seasonal, and 281 could not be determined or were classified as “other”. The claims that could not be determined were not included in the evaluation based on employment type. The total sample size included 67 claims after excluding the undetermined claims. The highest total benefit amount of \$766,354 between the years 2007-2017 was represented by part-time firefighters. Full-time firefighters represented the second highest, (\$385,988), followed by volunteer firefighters (\$110,446), and seasonal firefighters (\$24,087) as displayed in Figure 1. It should be noted that \$8,910,129 dollars allocated from total benefit amount was reported as “other” or was not specified.

July represented the month with the highest total benefit amount associated with wage loss claims and was also one of the highest months for number of injuries. July is classically the peak of the fire season for Montana as well as many other states [11]. The cost spent in July, over the ten year span, was \$1,770,859, representing 17% of the total benefits paid over the study period.

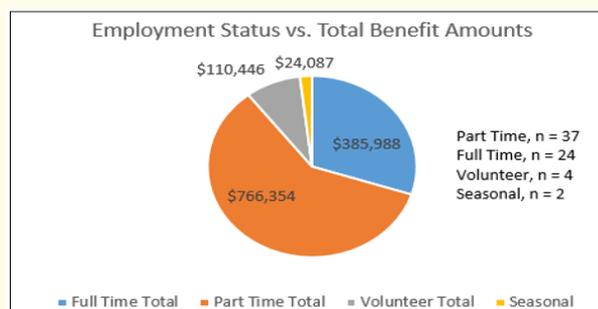


Figure 1: Total Benefit Amount from Montana Firefighter Workers’ Compensation Claims Categorized by Employment Type from 2007 through 2017.

Figure 2 shows the summer months represented a higher total benefit amount throughout the ten-year span compared to other seasons and displays the total benefit amount paid for each year from 2007-2017. The year(s) associated with the highest total benefit amounts were 2008 and 2009. The year 2008 experienced a total benefit cost amount of \$1,986,661.

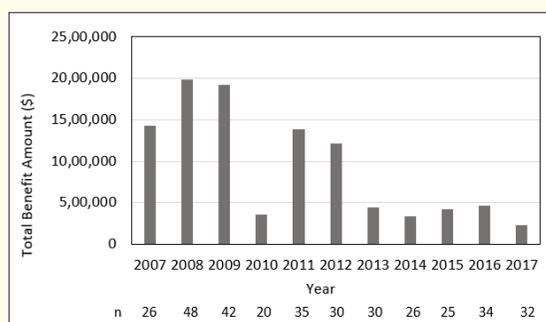


Figure 2: Total Benefit Amount Paid by Year from Montana Firefighter Workers’ Compensation Claims.

There was a total of 39 codes reported to describe nature of injury. The top five recorded “nature of injury” comprised of 85% of the 348 claims with wage loss. The majority of wage loss claims with the highest total benefit amount from 2007-2017 reported nature of injury as strain, sprain, multiple physical injuries, fracture, and bruise/contusion (Figure 3a).

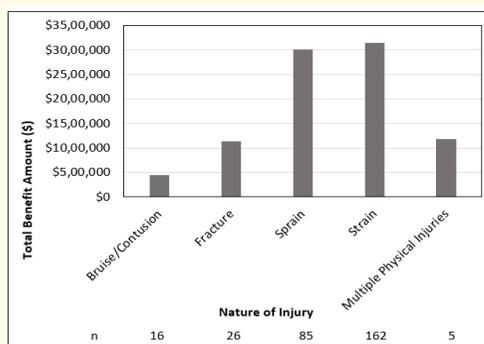


Figure 3a: Top Five Total Benefit Amount Costs by Nature of Injury of Montana Firefighter Workers’ Compensation Claims from 2007 through 2017.

Body part injured was evaluated. There were 32 codes to record injured body parts. The top five body parts injured were the back including the spine, knee, shoulder, multiple body parts, and ankle (Figure 3b). The five listed body parts comprised of 69% of the total 348 wage loss claims.

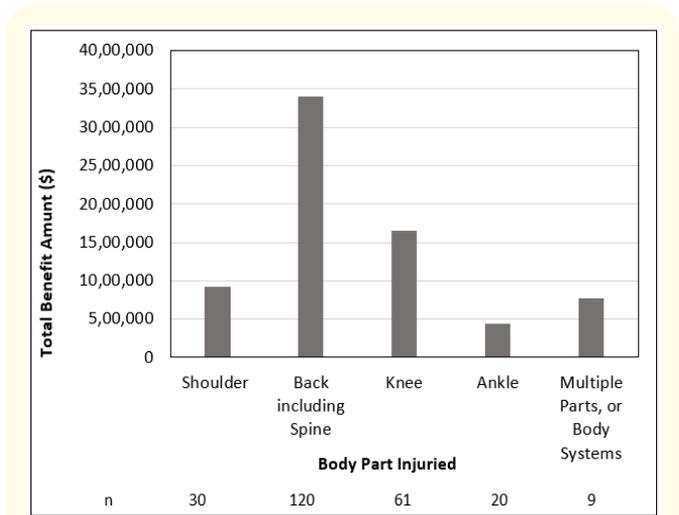


Figure 3b: Top Five Total Benefit Amount Costs by Body Part Injured of Montana Firefighter Workers' Compensation Claims from 2007 through 2017.

Cause of injury was also a variable of interest. There were a total of 65 codes to describe cause of injury, the top five reported cause of injury were pulled from the data. The top five causes made up 54% of the 348 wage loss claims. The majority of wage loss claims with the highest total benefit amount were caused by strain by lifting, followed by fall, slip, trip on same level, fall, and slip, trip from elevation, strain not otherwise classified, and strain by twisting (Figure 3c).

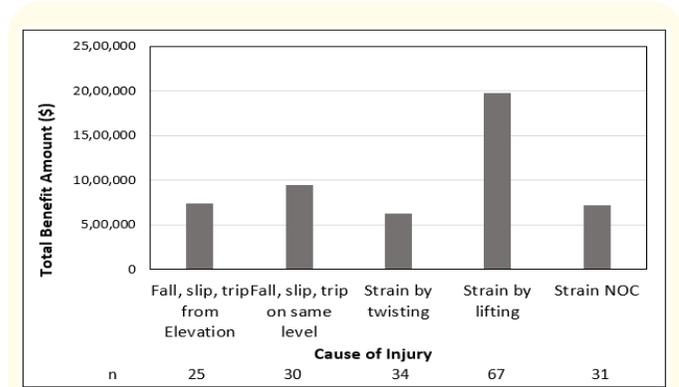


Figure 3c: Top Five Total Benefit Amount Costs by Cause of Injury of Montana Firefighter Workers' Compensation Claims from 2007 through 2017.

The activity at time of injury with the highest total benefit amount in the time period studied was classified as "other; maintenance activities, washing equipment, living at fire station". Claims that did not have an activity thoroughly described to place it in a distinct category, were also classified as "other". The next highest-cost activity was wildland firefighting followed by emergency med-

ical service, structural firefighting, and exercise/training (Figure 4).



Figure 4: Total Benefit Amount of Montana Firefighter Workers' Compensation Claims Categorized by Activity during which Injury Occurred.

The top five counties with the highest total benefit amount included Missoula, Flathead, Cascade, Gallatin, and Yellowstone (Figure 5). Missoula County had the highest total benefit amount between the years 2007-2017 of \$1,299,934. The county with the lowest total benefit amount in Montana between the years 2007-2017 was Rosebud. Many counties lacked information for total benefit costs due to subjective reporting. The total number of counties reporting losses was 28 out of the 56 counties in Montana.

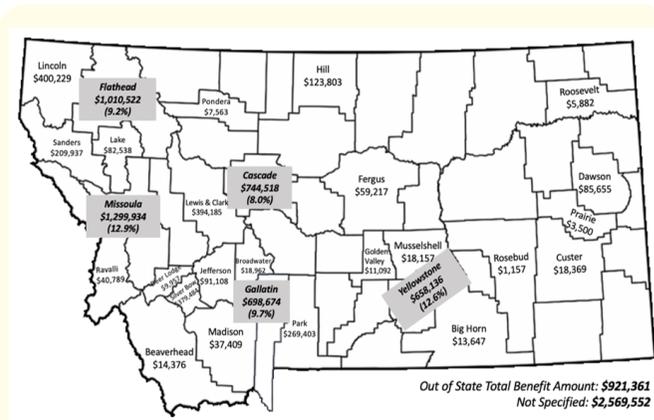


Figure 5: County Map of Montana displaying Total Benefit Amount per County from Firefighter Workers' Compensation Claims Filed Between the Years 2007 and 2017.

There was no significant difference between the median total benefit amount paid to the 326 male and 20 female claimants who had a lost-time injury case (Wicoxon statistic $[W] = 62,845$, $p = 0.161$). There was no significant difference in median total benefit amount between 24 full time versus 37 part time claimants with lost-time cases, ($W = 743$, $p = 0.994$). There were also no significant differences in median total benefit amount between private employment ($n = 52$) versus public employment ($n = 295$) ($W = 10,108$, $p = 0.112$) and wildland ($n = 46$) versus structural ($n = 29$) firefighting activity, ($W = 1,869$, $p = 0.190$). Note that the totals for these comparisons do not add up to the 348 lost-time injury claims

because many of the records were missing information needed to categorize them. The descriptive statistics for these comparisons are provided in Table 1.

Gender	N	Mean	Median	Median Diff.	95% Conf. Interval
Male	346	\$28,864	\$9,987	\$-5,422	(\$-14,747, \$1,458)
Female	20	\$39,231	\$15,409		
Employment Type	N	Mean	Median	Median Diff.	95% Conf. Interval
Full Time	24	\$16,083	\$9,782	-\$287	(\$-7,237, \$5,035)
Part Time	37	\$20,712	\$10,069		
Employment Sector	N	Mean	Median	Median Diff.	95% Conf. Interval
Private	52	\$66,020	\$11,354	\$1,905	(\$-448, \$9,534)
Public	295	\$22,901	\$9,449		
Firefighting Focus	N	Mean	Median	Median Diff.	95% Conf. Interval
Wildland	46	\$70,640	\$11,805	\$1,245	(\$-14,747, \$1,458)
Structural	29	\$18,524	\$10,560		

Table 1: Workers Compensation Claims - Total Benefit Amount.

Discussion

The results from this study provide a deeper understanding of cost factors related to firefighter injuries in Montana over an 11-year period from 2007 through 2017. Specifically, this evaluation revealed that total benefit amount paid for wage loss claims did vary depending on a number of factors. Certain job classifications, worker demographics, and injury factors were crucial in identifying areas of highest cost that could become priority areas for intervention, planning and improvement. Accurately assigning resource distribution or injury reserves is important for better cost estimations, benefit planning, and accountability. It also can inform a prioritization scheme for training techniques and other prevention strategies to reduce work related injuries and illness. Losses related to firefighters’ injuries were substantial over the study period and totaled \$10,199,116.

The 2017 Montana fire season was the most severe since 1910 with a total of 1.4 million acres burned from a total of 2,420 fires [11]. Brennan and Mutzenberger [11] found that the summer of 2017 saw an elevated number of firefighting workers’ compensation claims. However, the total benefit amount reported for 2017 only equaled \$228,593, which was substantially lower than the high seen over the study period in 2008 totaling \$1,986,661. Although 2008 had a higher economic burden due to wage loss claims than the year 2017, the 2008 fire season was less severe totaling 1,898 wildland fires with 166,840 acres burned [12]. The lower total benefit amount costs seen in 2017 may be due to inaccurate reporting or reduced severity of injuries.

The two highest nature of injury categories in terms of nature of injury were strains and sprains. This is in good agreement with other published findings. In a previous study of firefighters, most of the reported injuries were classified as strains, sprains, and muscular pain [10]. With regard to firefighting activity, McGinnis and Games [10] reported that 52.7% of injuries were reported

from fire-ground duties while 58.0% being strain, sprains and muscular pain. Our study found that 37% of total benefit amount costs were associated with either wildland or structure firefighting (both fire-ground activities), while all other activates made up the remaining 40% and 33% of all lost time claims were strains and sprains.

The most costly body part injured in the current study was the back including the spine, and the costliest cause of injury was strain by lifting. Further, Frost [13] evaluated cost of injuries in a large Canadian fire department in 2012 and found that 65% of injuries were classified as sprains and strains. Of the 65% of sprain and strains reported, 32% affected the back (Frost, 2016). Frost (2016) also found that the total cost of claims for the time period analyzed, was estimated at \$555,955 which included 77% sprain/strain injuries. The most expensive body parts injured related to MSDs included the knee (\$157,383), the back (\$100,459), and shoulder (\$76,838), total combined amounts in 2012. Results in Frost’s study showed that the majority of sprain and strain injuries occurred while employees conducted duties at the fire station. However, the most frequently reported and most costly activity was exercise and physical training activities (34%) [13]. Injuries that resulted from lifting were the most frequent as well as the costliest compared to other injuries [13].

Analysis showed no significant difference for median total benefit amount between male and female firefighters. Estimates derived from the 348 wage loss claims showed 326 (93.7%) of them were male and 20 (5.7%). The total benefit amount reported by male firefighters totaled \$9,409,693 and females totaled \$789,424 for the ten years of reported claims.

Firefighting is a historically male dominated profession [14]. Sinden [14] found that female firefighters are at an elevated risk for injury from occupational injuries and illnesses due to exposures in the firefighting industry. As work culture continues to evolve, both genders should continue to be evaluated. According to the BLS [6], from the years 2007-2011 men represented all firefighter fatalities in the United States. In 2011, women accounted for just 4.5% of employed firefighters in the United States and represented 8% of non-fatal injuries/illness [6].

There are several limitations associated with this study. The data originate from self-reported events and may be subject to response and recall bias. We received these data after the dataset was cleaned and managed at the Montana Department of Labor and Industry. Assumptions about the integrity and accuracy of the dataset were made. Worker’s compensation data are inherently limited in their inclusion of the many factors and characteristics associated with an injury or illness. As a result, the data presents limited options for understanding any single injury and the many variables that may have been truly associated with injury onset, progression, chronicity and/or recovery.

The BLS [1] estimates there are 730 paid firefighters employed by the State of Montana. Montana has 435 established fire departments, 400 of those departments rely on volunteer firefighters [15]. There are more volunteer firefighters in the United States than career firefighters, with 62% of firefighters in the United States are

classified as volunteer firefighters [3]. The data we obtained had limited information related to volunteer firefighters.

During the summer months, many federal wildland firefighters are brought in to aid in fighting wildland fires from neighboring states. However, federal wildland firefighters are not covered by Montana's workers' compensation system and thus were not included in this analysis. This results in an underestimation of actual losses associated with work related injury among firefighters in Montana. Under-reporting of injuries and illnesses is an issue when working with workers compensation data [9].

The data lack cancer cases and chronic illnesses that could be linked to firefighter exposures in the line of duty. The presumptive illness bill (Bill160) was signed into Montana State law in April 2019 which allows firefighters to file workers' compensation claims for specific presumptive occupational diseases such as respiratory and cardiovascular disease and certain types of cancer. Costs of injuries for the firefighting industry in Montana should continue to be evaluated in order to bring more awareness to severity of injuries, especially now that presumptive illnesses will be filed in claims.

Conclusion

Classifying injuries by nature of injury, body part injured, and cause is a standard workers' compensation claims reporting requirement. Our investigation of the lost time claims associated with firefighting in Montana has added to the paucity of published papers on the topic and added further knowledge related to cost and risk factors, and ultimately may lead to insight for injury prevention strategies. This study found that sprains and strains, back injuries, and lifting activities all represented the highest cost in their categories and we believe deserve focused attention from the industry.

The majority of costs were represented by publicly employed firefighters between 45-55 years of age. This group should receive close attention in future injury prevention programs. July was the month associated with the highest cost and is likely to remain as such because of seasonal conditions; however, with climate change we may see extended fire seasons and increased numbers and severity of fires [16-18]. Missoula County experienced the highest losses and paid greatest total benefit amount from claims data followed by Flathead, Gallatin, Cascade, and Yellowstone all of which make up the top five largest counties in the state of Montana. The state may wish to allocate greater resources to these higher risk counties to curtail future losses. Injuries and illnesses experienced in the firefighting industry should continue to be evaluated; much can be learned and is not fully understood [19-31].

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Conflicts of Interest

The authors declare no conflict of interest.

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