Analysis of Construction Worker Injuries That Do Not Result in Lost Time

Jimmie Hinze[1]; Jenny N. Devenport[2]; and Geneva Giang[3]

Abstract: Attempts to examine the root causes of injuries in the construction industry have been largely focused on fatalities and other serious injuries. These efforts were undertaken with the assumption that the root causes of serious injuries could lead to identifying approaches that could prevent the recurrence of similar injuries in the future and that these approaches would also be successful in eliminating many minor injuries. While some injuries may be either minor or serious depending on small differences in worker position, etc., that assumption does not appear to be valid for most injuries. The trends of causes leading to minor injuries are often quite different from those resulting in serious injuries. With this assumption, an examination was conducted to profile nearly 136,000 construction worker injuries, most of which did not result in lost time. Results indicate that these injuries, not resulting in lost time, generally do not fit the profile of injuries that result in fatalities or that are serious. Over half of the injuries in the present study were associated with lacerations (usually of the fingers and hand) and injuries sustained by the lumbar spine, upper extremities, or eyes. The percentage of injuries that involved lacerations was considerably higher for construction than for all other industries. The costs of injuries were found to be quite varied, depending on the part of the body that was injured.

DOI: 10.1061/(ASCE)0733-9364(2006)132:3(321)

CE Database subject headings: Construction industry; Injuries; Accidents; Occupational safety; Productivity.

Introduction

There is a considerable amount of published research on the nature and causes of fatalities and serious injuries in the construction industry. The results of these studies have been used to design and implement safety/injury prevention programs for the industry as a whole, for specific trades, and for specific tasks. In addition, these studies have been quoted as justifications for changes in the Occupational Safety and Health Administration (OSHA) regulations. For instance, relying in part on studies of fatalities and serious injuries, OSHA made significant changes to the trenching standards (CFR 1926, Subpart P, Excavations) (U.S. Department of Labor 2004) and to the standards on fall protection (CFR 1926, Subpart M, Fall Protection). Changes are currently being contemplated in the crane safety standards (CFR 1926, Subpart N, Cranes, Derricks, Hoists, Elevators, and Conveyors).

Construction workers sustain approximately half a million OSHA recordable injuries each year (National Safety Council 2001, 2002, 2003). For 2002, the Bureau of Labor Statistics (BLS) reported nonfatal injury and illness incidence rates of 7.1 recordable cases per 100 full time construction workers, with 2.8 cases per 100 workers resulting in days away from work (U.S. Bureau of Labor Statistics 2002). It is evident from these statistics that the majority of the injuries sustained by construction workers are not serious in the sense that they do not result in lost time. While minor injuries have not been the focus of extensive research, there is undoubtedly considerable suffering that accompanies some of these injuries and, in aggregate, they incur significant medical costs. This paper will show what types of minor injuries are frequent in the construction industry, examine the potential impact of minor injuries in terms of numbers of workers affected and average cost per injury, and make suggestions about benefits derived from looking at these data.

Research Methodology

The study of nonfatal construction injuries is often made more complex by the fact that this information is not readily available. OSHA keeps extensive, publicly accessible records on fatalities that are searchable by cause of injury. However, to conduct detailed analyses on nonfatal injuries, researchers frequently must turn to medical and/or workers' compensation claim records that are often categorized by type of injury (area of the body). The present research relied on medical clinic records to learn more about the nature of nonfatal construction injuries.

Injury data for this project were provided by Concentra Health Services, Inc., a full-service occupational medicine system with 250 medical clinics in 34 states. This organization maintains a proprietary information management system that contains patient demographic and injury data as well as outpatient treatment, diagnostic, billing, and outcomes information. This system tracks information on injury care provided to 500,000 workers annually

[1]Professor, M. E. Rinker Sr. School of Building Construction, College of Design, Construction, and Planning., Univ. of Florida, Gainesville, FL 32611-5701 (corresponding author). E-mail: hinze@ufl.edu

[2]Concentra, Inc., 5080 Spectrum Dr., Suite 400W, Addison, TX 75001; formerly, Statistician.

[3]Data Analyst, Concentra, Inc., 5080 Spectrum Dr., Suite 400W, Addison, TX 75001.

Note. Discussion open until August 1, 2006. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on June 11, 2004; approved on January 11, 2005. This paper is part of the ***Journal of Construction Engineering and Management***, Vol. 132, No. 3, March 1, 2006. ©ASCE, ISSN 0733-9364/2006/3-321–326/$25.00.

which equates to about 7% of all OSHA recordable illnesses and injuries in the United States. Of these injuries, over 40,000 involved construction workers. While these data do not represent a random sample of all occupational illnesses and injuries incurred, they do provide levels of detail on a very large sample of construction worker injuries that are not otherwise readily available. For the purposes of this project, these data provide sufficient information to profile minor injuries and document their impact on the construction industry in terms of raw frequency and medical costs.

Because the patients treated in these clinics come from a variety of different industries, the employer of the worker was used to identify the subset of patients from the construction industry. A list of potential construction employers was compiled using key words and company names from the *Blue Book* (a free listing of construction contractors and companies) [Contractors Register Inc. (2004)] and standard industry classification descriptions. Hundreds of potential text string searches were applied to the employer name field, yielding a list of over 100,000 potential construction employers. This list was then rescreened using text strings to eliminate employers not likely to be in construction or not employing construction workers, such as businesses involved only in supply rather than service or businesses involved in other industries altogether. The final employer list used to query for patients contained over 16,000 construction industry employers and yielded 135,998 injured workers who were treated during calendar years 2001–2003.

Analysis

Diagnosis information documented by the treating physician was used to calculate the frequency distributions of the injuries incurred by the identified patients. To simplify and create a meaningful summary, diagnosis codes (of which there are thousands) were categorized into 16 different nature of injury groups that account for the body part, and to some degree, the severity of injury. For example, separate groups are included for lumbar spine, cervical spine, and thoracic spine injuries; and there is a separate category for fractures inclusive of all body parts. Then the distributions of injuries for construction workers and nonconstruction workers were compared to gain insight on differential hazards. Within the construction industry, the injury distributions for men versus women and older versus younger workers were also compared. The medical charges per patient and across all patients were also assessed by type of injury.

Results

Table 1 presents the total counts and percentages of workers by nature of injury for 2001, 2002, and 2003, respectively. Only minor year-to-year variations in the nature of injury were observed, indicating relatively stable trends in the types of injuries incurred and/or receiving treatment. The most frequent types of injuries for this set of construction workers were lacerations (23.87%), lumbar spine (12.75%), upper extremity (11.37%), and eye (10.94%). These four categories accounted for 58.93% of the injuries reviewed. Most lacerations affected fingers and hands. Lumbar spine injuries generally involved lumbar sprains and nonspecific back pain (versus a more serious diagnosis such as disc displacement). Common upper extremity injuries included finger and hand contusions, wrist and finger sprains, joint pain, and crushing injuries. Eye injuries generally involved abrasions, inflammation, or scratches due to foreign bodies.

Table 1. Distribution of Construction Injuries by Year

Nature of injury	2001 (%)	2002 (%)	2003 (%)	Total (%)
Lacerations	23.8	23.8	24.0	23.9
Lumbar spine	12.6	12.8	12.9	12.8
Upper extremity	11.5	11.7	11.0	11.4
Eye	11.2	10.8	10.8	10.9
Ankle/foot	6.2	6.1	6.0	6.1
Soft tissue injuries	6.3	6.0	5.8	6.0
Knee	5.4	5.7	5.6	5.5
Shoulder/humerus	4.3	4.6	4.5	4.5
Fractures	4.2	4.3	4.4	4.3
Skin	3.7	3.6	3.7	3.7
Cervical spine	1.8	1.9	2.2	2.0
Non-Occ/NOC	2.0	1.8	2.0	1.9
Other/traumatic	1.8	1.8	1.9	1.8
Head/neck	1.7	1.7	1.9	1.8
Thoracic spine	1.8	1.9	1.7	1.8
Other/nontraumatic	1.8	1.6	1.7	1.7
Total	**43,897**	**45,957**	**46,144**	**135,998**

Fig. 1 shows the distributions of injuries for patients from construction and nonconstruction industries. Lacerations, upper extremity, and lumbar spine injuries were the most common for all patients. However, construction-industry patients had higher rates of lacerations, eye injuries, and fractures than all other patients. A cross-tab chi-square analysis between construction and other industries was conducted for the top four construction injuries and resulted in differences that are statistically significant at less than the 0.001 level.

The gender distribution split for the construction patients was 89% men and 11% women. Fig. 2 shows the differences in injury distributions for men and women in construction. As indicated in the graph, men and women had different injuries. Men were more likely to have lacerations and eye injuries while women were more likely to have upper extremity and lumbar spine injuries. These injury differences may reflect differences in craft functions and/or age for this set of workers.

The average age of construction workers in these data was 36, however women were older than men (average age 38.6 for women versus 35.7 for men). An analysis of variance on the differences in ages by gender showed a statistically significant difference at a level less than 0.001. As shown in Fig. 3, there were some differences in injury type due to age. In particular, younger workers were much more likely to have lacerations and eye injuries than older workers; while older workers were more likely to have knee, upper extremity, and lumbar spine injuries than younger workers. Further analysis revealed that differences in injury mix by age were present for men but not women. Most notably, men under the age of 35 were significantly more likely to have laceration injuries than men over 35 and women of any age (see Fig. 4).

In addition to raw counts and frequencies, the costs of injuries were reviewed. As shown in Table 2, lumbar spine injuries—which were some of the most frequently occurring—were also among the most costly. Approximately 20% of the total medical charges incurred by these construction patients were for lumbar spine injuries, and the average charge per patient for lumbar spine

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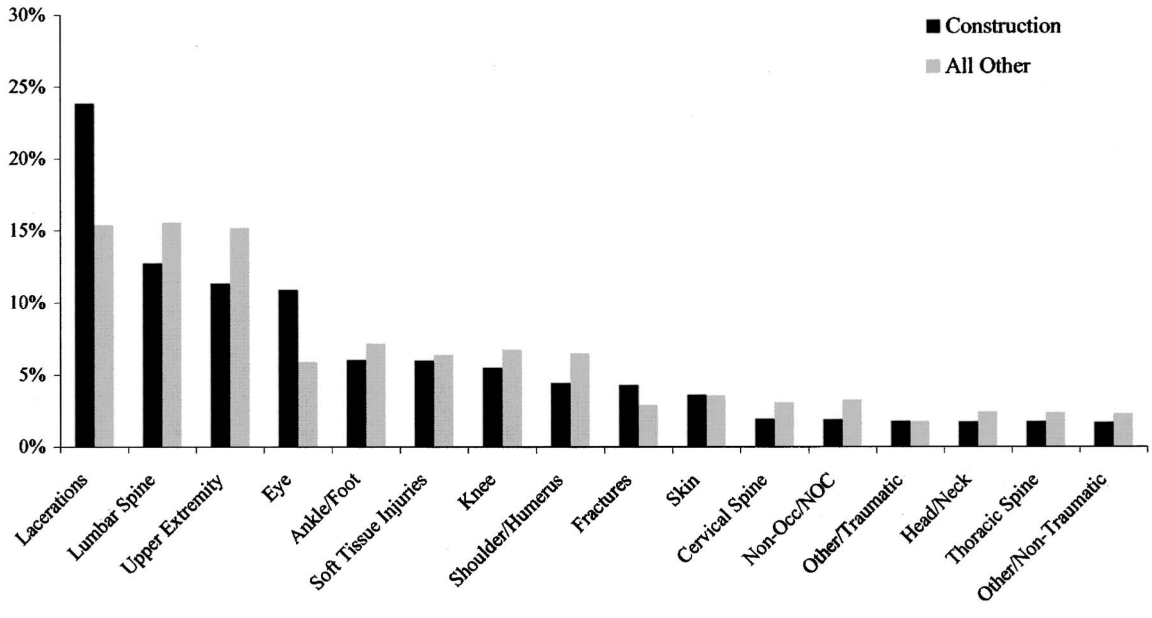

Fig. 1. Distribution of injuries for construction versus all other industries

injuries was in the top five for the injury categories studied.

Occupation/trade information may often (but not always) be available and recorded in the patient's medical record (paper) but was not available within the electronic dataset. With regard to higher average charge per patient, review of the dataset shows that there is a difference in the number of cases where total costs exceed \$10,000/case between shoulders and all other injuries, predominantly attributable to physical therapy services (see Table 3). Historically, shoulder injuries have a higher potential for surgery than other injuries and will incur additional physical therapy post-op, more than other injuries, driving up the average charge per patient for this type of injury.

Lacerations did not have a particularly high cost per case; but due to their frequency they represent a significant risk to the workers in addition to accounting for 16% of the medical costs. Eye injuries were among the lowest in cost per case and equate to 4.5% of the medical costs. However, eye injuries are among the easiest and least expensive to prevent through the use of appropriate protective eyewear.

Conclusions

The true value of conducting detailed analyses on injury data is achieved when patterns of causation and opportunities for prevention are identified. This information can then be utilized to implement specific safety techniques and procedures to ideally eliminate future occurrences. Realistically, at least in the short term, such information can best be utilized to reduce the incidence of specific injuries.

The results of the data analysis on nearly 136,000 construction

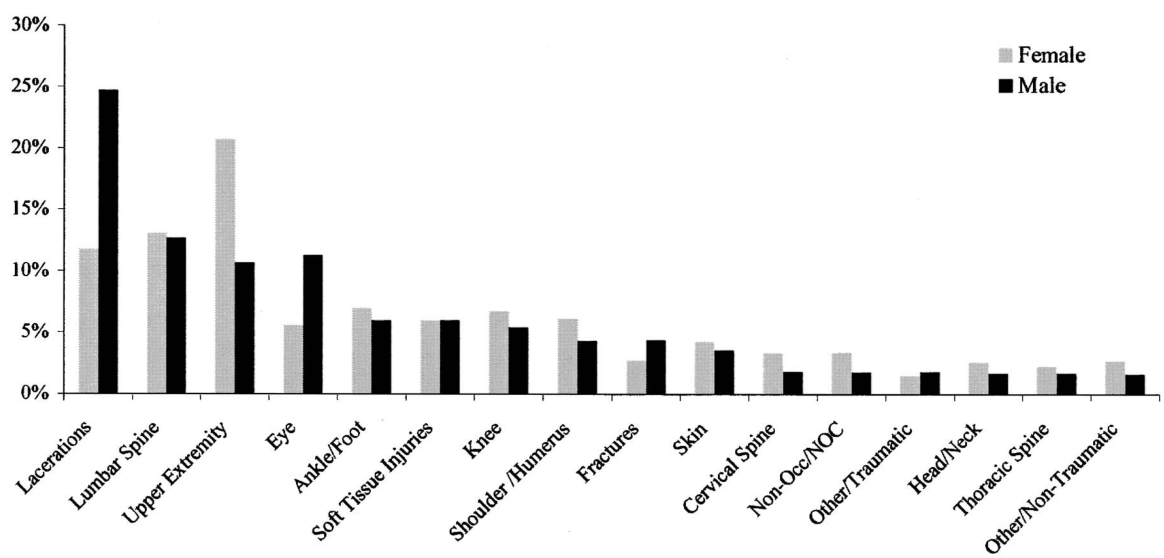

Fig. 2. Distribution of construction injuries by gender

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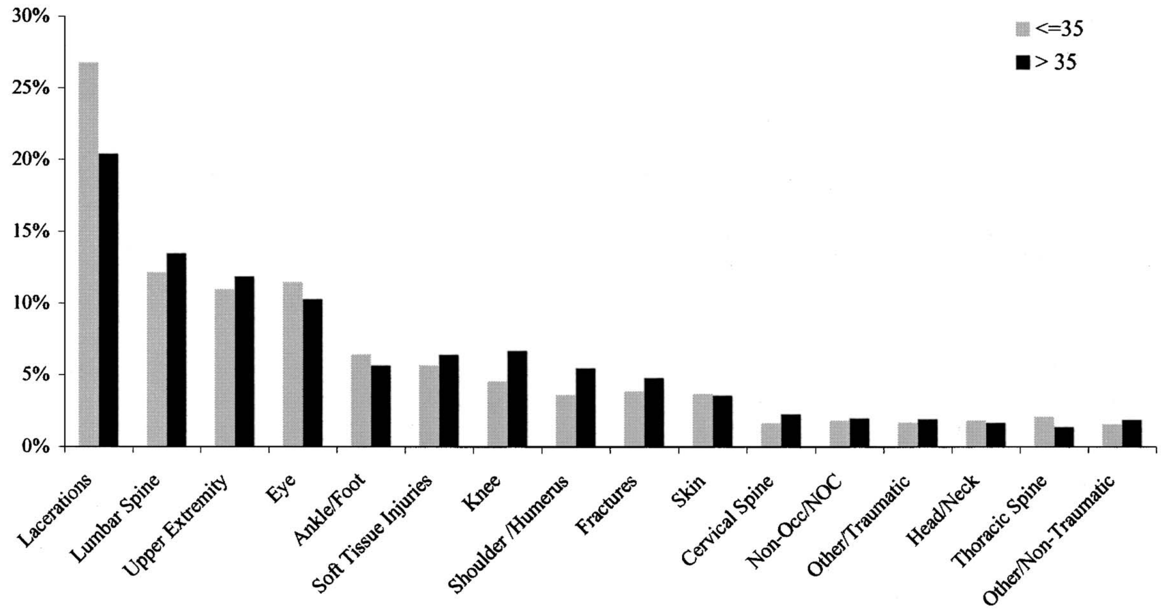

Fig. 3. Distribution of construction injuries by age

worker injuries help to identify certain patterns or trends in injury occurrence. First of all, the data show that there is relatively strong consistency from year to year in the frequency distribution of the injuries. This indicates that there is little variation in the distribution of injuries from year to year. Of the 16 injury categories into which all injuries were assigned, the most numerous injuries were lacerations, lumbar spine, upper extremity, and eye injuries. These four categories accounted for nearly 59% of all injuries. When compared to other industries, lacerations and eye injuries occur with much greater frequency in the construction industry.

The distribution of the injuries among the male and female workers shows that women have disproportionately more upper extremity injuries while men have disproportionately more lacerations. An examination of the data on lost time occurrences, including cases involving limited duty and lost days, showed that there is no significant difference in lost time occurrence by gender. Further, it must be recognized that gender and injury type may be related to the differences in the tasks being performed by the male and female workers.

When the ages of the injured workers were considered, additional variations in the pattern of injury occurrences were noted. The younger workers (less than 35 years of age) had considerably more lacerations than the older workers. Older workers had disproportionately more lumbar spine, cervical spine, soft tissue, fractures, shoulder/humerus, upper extremity, and knee injuries. For the older workers this injury distribution may well represent a combination of factors, including more brittle bones, slower reaction times, etc. Although not directly assessable with the present data, it is also suspected that older workers would often be in lead positions so their exposure to injury might be somewhat reduced and altered.

The data provided insights into the costs of injuries. The most costly injuries were the shoulder/humerus injuries. Although these injuries accounted for less than 5% of the injuries, their costs per patient would indicate that these would be of particular concern.

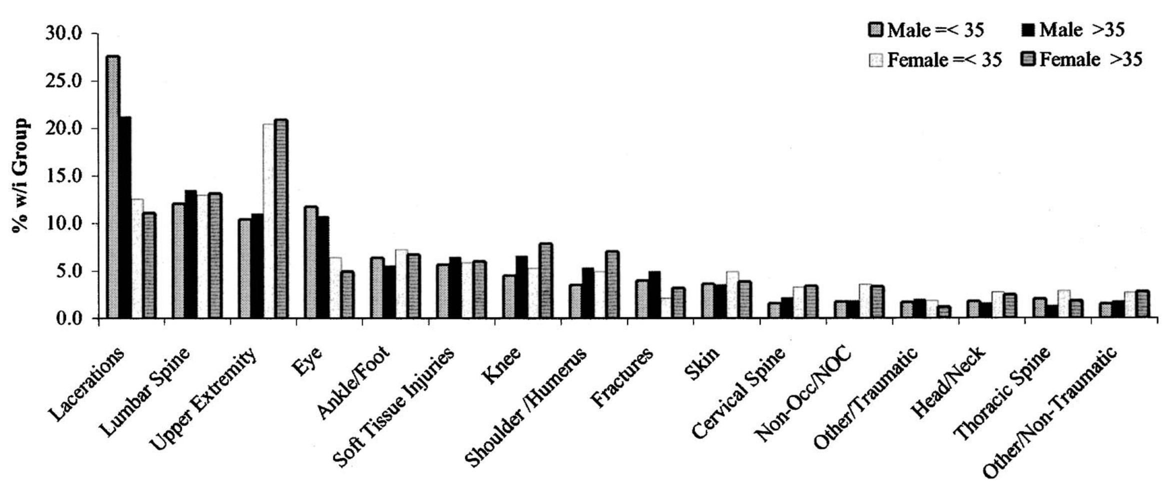

Fig. 4. Distribution of construction injuries by age and gender

Table 2. Comparison of Frequency and Primary Care Medical Expenses for Injuries

Nature of injury	Number of patients	Total patients (%)	Total medical charges ($)	Total charges (%)	Average charge/patient ($)	Rank average charges/patient
Lacerations	32,459	23.9	13,654,972.50	17.8	420.68	11
Lumbar Spine	17,342	12.8	15,399,391.19	20.0	887.98	2
Upper Extremity	15,466	11.4	9,368,597.82	12.2	605.75	8
Eye	14,880	10.9	3,773,156.96	4.9	253.57	16
Ankle/Foot	8,268	6.1	5,139,688.14	6.7	621.64	7
Soft Tissue Injuries	8,205	6.0	4,180,020.52	5.4	509.45	9
Knee	7,546	5.5	6,174,063.51	8.0	818.19	4
Shoulder /Humerus	6,096	4.5	5,692,319.42	7.4	933.78	1
Fractures	5,883	4.3	4,402,321.96	5.7	748.31	5
Skin	4,974	3.7	1,740,718.00	2.3	349.96	12
Cervical Spine	2,680	2.0	2,321,141.29	3.0	866.10	3
Non-Occ/NOC	2,622	1.9	872,394.61	1.1	332.72	14
Other/Traumatic	2,463	1.8	633,173.35	0.8	257.07	15
Head/Neck	2,412	1.8	1,092,072.51	1.4	452.77	10
Thoracic Spine	2,396	1.8	1,662,740.12	2.2	693.96	6
Other/Non-Traumatic	2,306	1.7	773,370.56	1.0	335.37	13
Total	**135,998**	**100.0**	**76,880,142.46**	**100.0**	**565.30**	

Note: Costs represent primary care medical charges (including physical medicine) from large Occupational Health Care Provider Group only and do not include any additional medical treatment provided by specialists, other primary care providers, diagnostic services, inpatient and other ambulatory facility charges, etc.

Eye injuries, on the other hand, were not very costly in comparison, but these might be dramatically reduced at a very low cost with rigid enforcement of the requirement to wear protective eyewear on construction sites.

The distribution of the injuries casts doubt on the old adage that the difference between a minor injury and a major one is measured in fractions of an inch. While in some cases this adage may be true, the data do not support this as a general rule. This may be one of the reasons why the computation of the experience modification rating (EMR) on workers' compensation insurance premiums is impacted by both frequency (of minor injuries) and severity. Prior studies have shown that most fatalities are attributed to falls, electrical shock accidents, struck by incidents, and caught in/between accidents. The most frequent causes of minor injuries may be related to other factors. While some of the eye injuries or lacerations, accounting for over one-third of the minor injuries, may be attributable to struck by and caught in/between incidents, there is some question as to whether all these injuries are the result of such causes. Injuries resulting from improper lifting, such as spine injuries, are also difficult to categorize by the major causes of fatalities.

Recommendations

The present findings provide some seemingly self-evident recommendations for researchers. While the analysis of the data reported in this paper was conducted with information that was previously coded for each injury case, additional research is warranted to examine information that is available but that is not currently coded. The database would need to be examined in detail to extract additional information about the circumstances of accidents from the transcriptions that accompany each injury report.

Contractors will do well to consider the distribution of the minor injuries. Even though the injuries carry the label "minor" they are still associated with human suffering. Just as contractors address the serious hazards (those which could easily cause a fatality) in their safety programs, it would appear logical to also implement specific programs to address minor injuries. For example, protective eyewear could be required to be worn at all times on construction project sites. Strict adherence to proper lifting techniques might also reduce the number of back or spine injuries. Some companies have implemented 100% tie-off

Table 3. Distribution of Treatment Charges Exceeding $10,000 by Nature of Injury

Nature of injury	Distribution of all injuries (%)	Distribution of injuries exceeding $10,000 (%)
Lacerations	23.9	4.2
Lumbar spine	12.8	12.5
Upper extremity	11.4	16.6
Eye	10.9	0
Ankle/foot	6.1	0
Soft tissue injuries	6.0	4.2
Knee	5.5	12.5
Shoulder/humerus	4.5	**37.5**
Fractures	4.3	12.5
Skin	3.7	0
Cervical spine	2.0	0
Non-Occ/NOC	1.9	0
Other/traumatic	1.8	0
Head/neck	1.8	0
Thoracic spine	1.8	0
Other/nontraumatic	1.7	0
Total	**100.0**	**100.0**

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programs to reduce the chance of injury related to falls. Similar programs could be implemented to prevent other types of injuries.

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