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This study describes work-related injury visits to the emergency department. The data used for this study was the 1999 National Hospital Ambulatory Medical Care Survey emergency department subsection. The patterns of work-related injury visits by month, day of the week gender, race/ethnicity, age, primary diagnosis and primary cause of injury are examined. The most common diagnoses for work-related injuries were sprains and strains, open wounds, and superficial injuries (71% of total visits). The most common causes of work-related injuries were sharp objects, overexertion, being struck, and falls (69% of total visits).

DESCRIPTIVE STUDY OF NON-FATAL OCCUPATIONAL INJURIES

TREATED IN THE EMERGENCY DEPARTMENT

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APPROVED:

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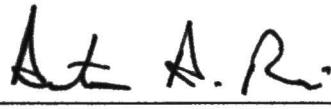

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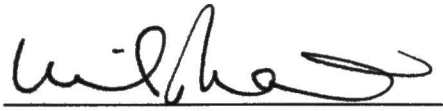

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DESCRIPTIVE STUDY OF NON-FATAL OCCUPATIONAL INJURIES TREATED IN THE EMERGENCY DEPARTMENT

THESIS

Presented to the School of Public Health

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DESCRIPTIVE STUDY OF NON-FATAL OCCUPATIONAL INJURIES TREATED IN THE EMERGENCY DEPARTMENT

INTRODUCTION

Non-fatal occupational injuries are preventable, and therefore are a matter of concern for the field of public health. Injuries cost time and money for employers and employees, not to mention short-term or long-term pain and suffering for the victim. It is important to look for differences and trends in the employees who fall victim to work-related injury so that effective intervention programs can be developed.

The first step in formulating strategies for the prevention of work-related injuries is to understand the scope of the problem. According to the Bureau of Labor Statistics (2000), there were 1,702,470 work-related injuries in private industries in 1999 that caused days away from work. Of these injuries, 66% were among men and 56% were among workers aged 25-44 years. Almost half of the injuries occurred in white non-Hispanic workers. Sprains, strains, bruises, contusions, cuts, lacerations, and punctures accounted for more than half of all injuries. More than two-thirds of the injuries were caused by overexertion, contact with objects and equipment, and falls (Bureau of Labor Statistics, 2000).

Hospital emergency departments are a major source of treatment for work-related injuries. However, there are few published studies that describe work-related injuries treated in the emergency department on a national level. McCaig, Burt, and Stussman (1998) described

work-related injuries treated in the emergency department from 1995 through 1996. In their study, data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) emergency department (ED) subsection were analyzed. They reported that 72% of work-related injury ED visits were made by males. There was no apparent difference in the frequency of visits when comparing blacks and whites. The leading causes of work-related injuries seen in the ED were cuts, being struck by or striking against an object, falls, and overexertion.

Two other studies reported on data from the National Electronic Injury Surveillance System (NEISS), which tracks emergency department injuries, including those that are occupational. The first of these studies described the 1996 data (Centers for Disease Control [CDC], 1998). Males accounted for 69% of occupational injury visits. Most of the work-related injury visits (71%) were made by workers who were aged 25-54 years, while 23% of visits were by 16-24 year olds. The most common diagnoses for the work-related injuries were sprain and strain (27%), lacerations (22%), and contusions, abrasions, and hematomas (20%).

In the second study (Jackson, 2001), which described 1998 emergency department data, the leading causes of injuries were contact with objects, overexertion, and falls. The most common diagnoses were lacerations, punctures, amputations, and avulsions, which represented 27% of all visits, followed by sprains and strains (25% of injuries) and contusions, abrasions, and hematomas (21%).

A descriptive analysis of time trends, demographic characteristics (gender, race/ethnicity, and age of injured workers), as well as the nature and cause of work-related injuries, from a national medical care survey can contribute to the development of a profile of work-related injuries. The present study describes available national data on non-fatal occupational injuries treated in the emergency department.

The data for this study were extracted from the 1999 NHAMCS ED subsection and used to address the following questions:

1. Are there trends in the frequency of occurrence of work-related injuries treated in the emergency department by day of the week or month of the year?
2. What is the pattern of incidence of work-related injury treated in an emergency department with respect to the major demographic variables of gender, race/ethnicity, and age?
3. What are the major diagnoses and causes of the work-related injuries for which the victims seek treatment in emergency departments and how are these distributed by gender, race/ethnicity, and age?

METHODS

Data from the emergency department subsection of the NHAMCS conducted in 1999, the most recent year for which data from this survey are available, were used in this analysis. The NHAMCS is a national probability sample survey of hospital outpatient visits and emergency department visits. The NHAMCS has been conducted annually since 1992 by the National Center for Health Statistics. The NHAMCS is a public-use data set. Consequently, the data set includes no personal identifiers and confidentiality of patient records is protected. The data can be accessed at the following URL:

ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Datasets/NHAMCS/ed1999.exe.

The NHAMCS uses a four-stage probability design sample of U.S. hospitals and includes non-institutional general and short-stay hospitals, exclusive of federal, military and Veterans Administration hospitals (CDC, 2001). The first-stage sampling frame consists of 112 primary sampling units (PSUs). A PSU is a county, group of counties, county equivalents, towns, townships, minor civil divisions, or a metropolitan statistical area. In the second stage, hospitals are sampled from the PSUs. In the third stage, clinics and emergency departments within the hospitals are sampled. In the fourth and final stage, a sample of patient visits is randomly selected from each clinic and emergency department.

The maximum sampling rate is one in 20 visits or no more than 200 visits from each clinic and emergency department, whichever yields a smaller sample size. The survey data for each visit that was sampled was collected on a patient record form by trained hospital staff.

The 1999 NHAMCS included data collected from December 21, 1998 through December 19, 1999. The survey sample included 427 eligible hospitals, and 94% of eligible hospitals participated in the survey. Of these hospitals, 404 had 24-hour emergency departments. Data from visits to the emergency departments of these hospitals are included in the NHAMCS emergency department (ED) subsection.

In the 1999 NHAMCS, a total of 21,103 ED visit patient record forms were completed. Of these, 866 were for visits meeting NHAMCS criteria for classification as a work-related injury. In the NHAMCS, an injury is categorized as work-related if it occurs anywhere on an employer's premises or off an employer premises if the injury occurred while working for pay or compensation (even if at home), working as a volunteer fire fighter, law enforcement officer or EMT; or during work in a family business, including family farms; or traveling on business; or in vehicles that are part of the work environment, such as taxi drivers (CDC, 2001). These ED visits for work-related injuries were the source of data for the current study.

For purposes of this study, a lower age limit of 15 years was established. Based on this criteria, six work-related injury visits were excluded from the 1999 NHAMCS ED subsection. The remaining 860 eligible hospital emergency department work-related injury visits in the 1999 NHAMCS were analyzed for time trends (month and day of week of visit), distribution by demographic variables (sex, age, and race/ethnicity), type of injury according to the primary physician diagnosis, and primary cause of injury. The cause of injury and primary physician diagnosis are coded in the NHAMCS according to the International Classification of Disease, Clinical Medicine, 9th Revision (ICD-9-CM).

The race/ethnicity data on patients was categorized as white Hispanic, white non-Hispanic, black, and other races. Age was categorized into four 10-year age groups from age 15 through age 54, and a fifth group for workers age 55 and older. For purposes of these analyses,

the primary diagnostic categories as to the type of injury were restricted to the seven most common diagnoses with the remaining less frequent diagnoses classified as "other." The diagnostic categories reported for this study are:

1. Fracture
2. Sprain/Strain/Dislocations/Joint Injuries (hereinafter referred to as Sprain/Strain for the sake of brevity)
3. Open Wound
4. Superficial Injury/Contusion (hereinafter referred to as Superficial Injury for the sake of brevity)
5. Foreign Body
6. Burn/Dermatitis
7. Poisoning/Toxic Effect/External Cause (hereinafter referred to as Poisoning for the sake of brevity)
8. All Other Diagnoses

The primary diagnoses were cross-tabulated by the demographic variables of sex, race/ethnicity, and age group to describe the pattern of types of injuries sustained by each of these respective groups.

Similarly, the primary causes of injury were limited in the analyses to the eight most commonly occurring causes, with the remainder of causes grouped as "other." Visits which had no cause of injury listed were grouped as "unknown." The categories of causes of work-related injuries used in the present study are as follows:

1. Transportation Accident
2. Poisoning/Environmental Factor/Adverse Effect of Therapeutic Drug (hereinafter referred to as Poisoning for the sake of brevity)

3. Fall
4. Fire/Explosion/Hot Object/Corrosive/Electricity (hereinafter referred to as Fire/Explosion for the sake of brevity)
5. Foreign Body
6. Struck By/Caught Between (hereinafter referred to as Struck By or Being Struck for the sake of brevity)
7. Sharp Object/Machinery (hereinafter referred to as Sharp Object for the sake of brevity)
8. Overexertion/Strenuous Movement (hereinafter referred to as Overexertion for the sake of brevity)
9. All Other Causes
10. Unknown

Cross-tabulations were performed of the major cause of injury versus the demographic variables of sex, racial/ethnic group, and age to identify the pattern of causes of work-related injuries in these groups.

RESULTS

There were a total of 860 emergency department (ED) visits for work-related injuries by persons aged 15 and older in the 1999 NHAMCS ED subsection. Of the total number of occupational injury visits, 71% were made by men (n=606) and 30% by women (n=254).

Table 1 shows the distribution of ED visits for work-related injuries by month. The proportion of visits by month was fairly evenly distributed throughout the year. The monthly pattern of visits did not exhibit any seasonal variation. The highest frequency of work-related injury visits to the ED was during the month of August (10%), while the lowest frequency of visits was during the month of May (6%).

Table 1
Distribution of ED Visits for Work-Related Injury by Month

Month	No.	%
January	70	8.2
February	80	9.3
March	83	9.7
April	83	9.7
May	52	6.0
June	70	8.1
July	59	6.9
August	87	10.1
September	54	6.2
October	77	9.0
November	84	9.8
December	61	7.1
Total	860	100.1

During the conventional work week (Monday through Friday), the proportion of ED visits by day averaged 16% and was nearly constant (Table 2). The proportion of ED visits did decrease on weekends compared to the work week: 11% of visits were on Saturdays and 8% on Sundays.

Table 2
Distribution of ED Visits for Work-Related Injury by Day of the Week

Day	No.	%
Monday	136	15.8
Tuesday	155	18.0
Wednesday	136	15.8
Thursday	129	15.0
Friday	141	16.4
Saturday	93	10.8
Sunday	70	8.1
Total	860	99.9

The age distributions of persons making work-related injury ED visits for the total study sample and separately for females and males are presented in Table 3. One-fifth of all ED visits were for injuries among workers under age 25 and nearly half were for injuries among workers under age 35. Over three-quarters of work-related injury visits to the ED were made by workers under age 45. Only 6% of visits were among workers aged 55 and over.

Except for a modest shift to a higher proportion of visits by older female workers, the age distributions of work-related injury ED visits were not markedly different between the sexes. Among females, 9% of ED visits for work-related injuries were among those aged 55 and older while among males, 5% of visits fell into this age category.

Table 3
Age Distribution of ED Visits for Work-Related Injury Overall and by Gender

	Females		Males		Total	
Age (in years)	No.	%	No.	%	No.	%
15-24	45	17.7	122	20.1	167	19.4
25-34	73	28.7	187	30.9	260	30.2
35-44	74	29.1	170	28.1	244	28.4
45-54	39	15.4	95	15.7	134	15.6
≥55	23	9.1	32	5.3	55	6.4
Total	254	100.0	606	100.1	860	100.0

The distribution of ED visits by race/ethnicity was 71% among white non-Hispanics, 16% among blacks, 8% among white Hispanics, and 4% among other races. Table 4 shows the proportion of females and males by racial/ethnic group. Females accounted for 45% of visits among blacks in contrast to 20% among white non-Hispanics and 27% among white Hispanics.

Table 4
Gender Distribution of ED Visits for Work-Related Injury Overall and by Race/Ethnicity

	Females		Males		Total	
Race/Ethnicity	No.	%	No.	%	No.	%
White Non-Hispanic	167	27.3	445	72.7	612	100
White Hispanic	15	19.7	61	80.3	76	100
Black	63	44.7	78	55.3	141	100
Other	9	29.0	22	71.0	31	100

The distribution of the primary diagnosis for ED visits is shown in Table 5. The most common diagnoses of work-related injuries seen in the ED were sprains and strains (29%), open wounds (26%), and superficial injuries (16%). These three diagnoses accounted for 70% of the total ED visits for work-related injuries. While the proportion of these three diagnoses were similar for women (74%) and men (70%), there were modest differences in the frequency of specific diagnoses between the sexes. Women had a slightly lower proportion of open wounds and fractures than men and conversely a slightly higher proportion of sprains and strains and

superficial injuries. Other diagnoses were considerably less common: 5% for treatment of fractures, 4% for burns or dermatitis, and 3% for removal of a foreign body.

Table 5
Distribution of Diagnosis of ED Visits for Work-Related Injury Overall and by Gender

	Females		Males		Total	
Diagnosis	No.	%	No.	%	No.	%
Sprain/Strain	88	34.6	164	27.1	252	29.3
Open Wound	51	20.1	168	27.7	219	25.5
Superficial Injury	49	19.3	89	14.7	138	16.0
Fracture	7	2.8	32	5.3	39	4.5
Burn/Dermatitis	11	4.3	19	3.1	30	3.5
Foreign Body	4	1.6	20	3.3	24	2.8
Poisoning	3	1.2	7	1.2	10	1.2
Other	41	16.1	107	17.7	148	17.2
Total	254	100.0	606	100.1	860	100.0

As presented in Table 6, the most common diagnosis in white Hispanics and blacks was sprains and strains (37% and 38% respectively) while open wounds were the most common diagnoses among white non-Hispanics and other races (28% and 26% respectively). In all four racial/ethnic groups, sprains and strains, open wounds, and superficial injuries combined accounted for the vast majority of work-related injuries treated in the ED.

Table 6
Distribution of Diagnosis of ED Visits for Work-Related Injury by Race/Ethnicity

	White Non-Hispanic		White Hispanic		Black		Other	
Diagnosis	No.	%	No.	%	No.	%	No.	%
Open Wound	169	27.6	15	19.7	27	19.1	8	25.8
Sprain/Strain	163	26.6	28	36.8	54	38.3	7	22.6
Superficial Injury	102	16.7	13	17.1	18	12.8	5	16.1
Fracture	31	5.1	2	2.6	5	3.5	1	3.2
Foreign Body	23	3.8	1	1.3	0	0.0	0	0.0
Burn/Dermatitis	21	3.4	2	2.6	6	4.3	1	3.2
Poisoning	8	1.3	0	0.0	2	1.4	0	0.0
Other	95	15.5	15	19.7	29	20.6	9	29.0
Total	612	100.0	76	99.8	141	100.0	31	99.9

When the pattern of primary diagnoses of workers treated in the ED is examined by age, again sprains and strains, open wounds, and superficial injuries were the dominant types of injuries (Table 7). Open wounds accounted for 37% of ED visits among workers aged 15-24 compared to 25% or less among the other age groups. Sprains and strains were the most common diagnoses of work-related injury ED visits by persons 25 and older (28%-32%). Fractures accounted for 9% of ED visits among those aged 45-54 and 15% of those over age 55.

TABLE 7
Distribution of Diagnosis of ED Visits for Work-Related Injury by Age

	15-24		25-34		35-44		45-54		≥55	
Diagnosis	No.	%	No.	%	No.	%	No.	%	No.	%
Open Wound	61	36.5	56	21.5	60	24.6	32	23.9	10	18.2
Sprain/Strain	44	26.3	83	31.9	71	29.1	38	28.4	16	29.1
Superficial Injury	26	15.6	45	17.3	39	16.0	19	14.2	9	16.4
Burn/Dermatitis	9	5.4	9	3.5	9	3.7	2	1.5	1	1.8
Foreign Body	4	2.4	6	2.3	12	4.9	2	1.5	0	0.0
Fracture	3	1.8	10	3.8	6	2.5	12	9.0	8	14.5
Poisoning	1	0.6	4	1.5	4	1.6	1	0.7	0	0.0
Other	19	11.4	47	18.1	43	17.6	28	20.9	11	20.0
Total	167	100.0	260	99.9	244	100.0	134	100.1	55	100.0

Overall, the four leading causes of work-related injury seen in the ED were sharp objects (24%), overexertion (16%), being struck (15%), and falls (14%) (Table 8). These made up more than two-thirds of the causes of ED-treated work-related injuries. Among males, sharp objects caused the highest proportion of work-related injuries (27%). Among females, overexertion was the leading cause, accounting for 20% of all work-related injury ED visits. The less frequent causes of work-related injury were transportation accidents, foreign bodies, fires and explosions, and poisoning, all of which collectively caused less than one-fifth of work-related injury visits to the ED.

Table 8
Distribution of Cause of Injury of ED Visits for Work-Related Injury Overall and by Gender

	Females		Males		Total	
Cause of Injury	No.	%	No.	%	No.	%
Sharp Object	46	18.1	164	27.1	210	24.4
Overexertion	50	19.7	85	14.0	135	15.7
Struck By	35	13.8	94	15.5	129	15.0
Fall	40	15.7	77	12.7	117	13.6
Transportation Accident	10	3.9	42	6.9	52	6.0
Foreign Body	9	3.5	31	5.1	40	4.7
Fire/Explosion	11	4.3	21	3.5	32	3.7
Poisoning	10	3.9	14	2.3	24	2.8
Other	32	12.6	54	8.9	86	10.0
Unknown	11	4.3	24	4.0	35	4.1
Total	254	99.8	606	100.0	860	100.0

Injury due to sharp objects was the leading reason for work-related ED visits among white non-Hispanics (26%) and white Hispanics (21%) (Table 9). The most common cause among black/African-Americans was overexertion (23%) followed closely by sharp objects (21%). Being struck was the primary cause of work-related injury ED visits among other races.

Table 9
Distribution of Cause of Injury of ED Visits for Work-Related Injury by Race/Ethnicity

	White Non-Hispanic		White Hispanic		Black		Other	
Cause of Injury	No.	%	No.	%	No.	%	No.	%
Sharp Object	159	26.0	16	21.1	29	20.6	6	19.4
Overexertion	89	14.5	10	13.2	33	23.4	3	9.7
Struck By	86	14.1	12	15.8	21	14.9	10	32.3
Fall	82	13.4	13	17.1	20	14.2	2	6.5
Transportation Accident	36	5.9	7	9.2	9	6.4	0	0.0
Foreign Body	34	5.6	4	5.3	1	0.7	1	3.2
Fire/Explosion	25	4.1	1	1.3	5	3.5	1	3.2
Poisoning	18	2.9	1	1.3	5	3.5	0	0.0
Other	58	9.5	6	7.9	15	10.6	7	22.6
Unknown	25	4.1	6	7.9	3	2.1	1	3.2
Total	612	100.1	76	100.1	141	99.9	31	100.1

Table 10 shows that sharp objects were the most common cause of work-related injury for those under age 45. For those aged 45 and older, falls were the leading cause of injury. Falls were responsible for 21% of work-related injury ED visits among those aged 45-54 and 33% of work-related injury ED visits among those aged 55 and older.

Table 10
Distribution of Cause of Injury of ED Visits for Work-Related Injury by Age

	15-24		25-34		35-44		45-54		≥55	
Cause of Injury	No.	%	No.	%	No.	%	No.	%	No.	%
Sharp Object	61	36.5	56	21.5	56	23.0	25	18.7	12	21.8
Overexertion	35	21.0	40	15.4	34	13.9	20	14.9	6	10.9
Struck By	19	11.4	38	14.6	43	17.6	23	17.2	6	10.9
Fall	10	6.0	30	11.5	31	12.7	28	20.9	18	32.7
Foreign Body	8	4.8	12	4.6	17	7.0	3	2.2	0	0.0
Transportation Accident	7	4.2	18	6.9	15	6.1	8	6.0	4	7.3
Fire/Explosion	7	4.2	12	4.6	10	4.1	2	1.5	1	1.8
Poisoning	4	2.4	10	3.8	4	1.6	5	3.7	1	1.8
Other	10	6.0	29	11.2	25	10.2	17	12.7	5	9.1
Unknown	6	3.6	15	5.8	9	3.7	3	2.2	2	3.6
Total	167	100.1	260	99.9	244	99.9	134	100.0	55	99.9

DISCUSSION

No trend was observed in the proportion of work-related injury visits to the emergency department by month (Table 1). No trend by day of the week was observed. There was a lower proportion of visits on weekends than on weekdays (Table 2). More visits on any given weekday versus a weekend day may be explained by the assumption that more people work and are therefore injured during the week than during the weekend.

More work-related injury visits to the emergency department were by males (71%) than by females. In terms of age, over one-half of visits were by persons who were 25-44 years old (Table 3). Most visits were made by white non-Hispanics (Table 4).

The primary diagnoses for work-related injuries in the 1999 NHAMCS ED subsection were sprains and strains, open wounds, and superficial injuries (Table 5). This was observed regardless of sex, age, or race/ethnicity. Some differences within the demographic subgroups were observed. Males had a higher percentage of open wound and fracture diagnoses than females. Females had higher percentages of sprains and strains and superficial injuries than males. Referring to Table 6, blacks and white Hispanics had higher proportions of sprains and strains and open wounds than white non-Hispanics and other race/ethnicities. Blacks had fewer superficial injury diagnoses than all other race/ethnicity groups. Fracture diagnoses were more frequent in the older age groups (Table 7).

Most of the work-related injury visits in the 1999 NHAMCS ED subsection were caused by falls, being struck by objects, sharp objects, and overexertion (Table 8). This pattern was also observed across each race/ethnicity group, with only minor variations in the distribution of causes

(Table 9). Compared with females, males had higher percentages in the cause of injury categories of transportation accidents, being struck, and sharp objects (Table 8). Females had higher percentages of falls and overexertion than males.

From age 15-44, the greatest single cause for work-related injury seen in the emergency department was sharp object (Table 10). The greatest single cause from age 45 years and over was a fall. There was an increase in the frequency of falls in each age group, rising to 32% in the age group 55 years and older.

Since the NHAMCS subsection used in the present study is a survey of patients treated in emergency departments, only those workers who sought emergency department treatment for their injuries can be described. However, all work-related injuries would include those that have gone untreated, were seen as outpatients, or were hospitalized; such injuries are not addressed in these analyses.

Rates of injuries cannot be calculated from this sample survey data as the corresponding population denominators cannot be determined. Consequently, the relative risks of injuries among workers in different demographic groups cannot be estimated. Type of occupation of the patients, which would be of clear use in targeting higher risk workers, was not collected in the NHAMCS and therefore cannot be examined.

Selected NHAMCS responses are self-reported by the patient and thus may contain errors. Potentially prone to error in reporting may be whether or not the injury was work-related. In the event that work-related injuries were misclassified or were not included, the reported patterns could differ.

From the public health standpoint, emergency department visits should be considered an opportunity to counsel victims of occupational injury on the prevention of future injuries. However, as more data is analyzed and more trends in work-related injury are found, prevention

at the worksite would be the ultimate goal in reducing the frequency of occupational injury. Prevention of injury is a multi-level approach, and aside from training the workforce on preventing injury, another important step is to remove the hazards. According to the results of this study, efforts need to be made to prevent dangerous contact with sharp objects, overexertion, falling, and being struck by objects. The use of safety knives and scissors, personal protective equipment, clearing walkways of obstacles, and training on proper lifting techniques for heavy objects are a few examples of what can be done.

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