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OCCUPATIONAL INJURIES IN RUBBER INDUSTRY

SUMMARY

The aim of this study is to examine the epidemiological characteristics of traumatic occupational injuries in rubber industry workers registered in the period between the 1993 and 2003. The occupational accidental workplace injuries are most frequent among young, less experienced workers. The injuries in occupational accidents are most frequent in May, on Monday, between 8 am and 10 am. The most common type of occupational injuries were closed fractures, open fractures and dislocated fractures. Upper and lower extremities were the most frequently injured parts of the body in occupational injuries. These injuries resulted in 70.4 ± 5.8 days per injured worker, which is higher than in the literature data. These findings are important for the control and prevention of occupational injuries in rubber industry.

***Key words*: Occupational injury, rubber industry, workers, occupational accidents**

INTRODUCTION

The overall human, social, and financial toll of traumatic occupational injury is enormous, rivaling the burden imposed by such health threats as cancer and cardiovascular diseases (1, 2). The direct cost (lost wages, medical and rehabilitation payments, insurance administrative costs, property loses, production loses, temporary and permanent disabilities) plus indirect costs (cost associated with pain and suffering by workers and family members) of occupational injuries were estimated in USA to be about US$ 30 billion annually (3).

Traumatic occupational injuries and fatalities result from multiple causes, affect different segments of the working population, and occur in a myriad of occupations and industrial settings. Individual characteristics of workers and environmental hazards can be the contributing factors in the occurrence of occupational accidents and injuries (4–6). Workers in rubber industry are exposed to numerous hazards in the workplace, such as noise, vibrations, bad microclimatic factors, exposure to toxic agents and dust, poor illumination and ventilation.

THE AIM OF THE STUDY

The aim of this study was to examine the epidemiological characteristics of traumatic occupational injuries in workers in rubber industry in the period between 1993 and 2003.

MATERIAL AND METHODS

An injury was defined as occupational if it occurred while working for compensation (injuries in

accidents at workplace), while arriving at or leaving work (injuries in commuting accidents) and in the traffic on the way to work (injuries in accidents in the traffic to work). All injuries, which had resulted in at least one day's absence from work after the day of the injury, formed the basis of the analysis. When an injury occurs, data are entered by the management representatives of the safety department and the industry plant medical staff. The data set includes information on employee characteristics (e.g. sex, age, working experience, education), characteristics of the workplace and event, description of the injury (date, time of day, injury type and body part injured) and outcome (lost days, days on which employees reported to work but were assigned to light or alternative duties). All injuries analyzed must have met one or more of the following conditions: medical treatment required restriction of work or motion, transfer to another job or resulted in death. The circumstances of each incident were reviewed using the variables in the database, including the narrative description of "how the injury occurred", the nature of the injury, the injured workers job title, and recommendations to prevent future occurrences. External cause of injury in database was based on codes from the International Classification of Diseases (7), excluding only suicide and medical misadventure.

For the days away from work, calculation of the number of calendar lost days resulting from occupational injuries was divided by the number of injured workers.

RESULTS

In the examined period 536 traumatic occupational injuries occurred in the rubber industry (474 in accidents at workplaces, 34 in accidents in the traffic to work and 28 in commuting accidents). Occupational injuries in accidents at workplace are most frequent among young workers. The number of injuries in commuting accidents rises by the age of workers (table 1).

Traumatic occupational injuries in accidents at workplace are most frequent among less experienced workers (table 2).

The highest number of injuries in accidents at workplaces occurred between 8 a.m. and 10 a.m., in the traffic from work between the 4 a.m. and 6 a.m. and in commuting accidents between the 2 p.m. and 4 p.m. (table 3).

The injuries in occupational accidents are most frequent on Monday (table 4).

Distribution of occupational injuries by the month of the years showed the peaks in May, October and November. The highest number of injuries in commuting accidents occurred in winter months (table 5).

The most common types of occupational injuries were closed fractures, open fractures and dislocated fractures. The most common type of injuries in commuting accidents was sprains and strains (table 6).

Upper and lower extremities were the most frequently injured parts of the body in occupational injuries (table 7).

Table 1. Distribution of injuries by age of injured worker

Age (Years)	Location of the accidents							
	Accidental injuries at workplace		Accidental injuries in traffic to work		Injuries in commuting accidents		Total	
	N	%	N	%	N	%	N	%
Under 20	98	20.7	7	20.6	3	10.7	108	20.1
20-29	105	22.1	8	23.5	3	10.7	116	21.6
30-39	87	18.3	5	14.7	5	17.8	97	18.1
40-49	71	14.9	5	14.7	5	17.8	81	15.1
50-59	58	12.2	5	14.7	5	17.8	68	12.7
60-65	55	11.6	4	11.8	7	25.0	66	12.3
Total	474	100.0	34	100.0	28	100.0	536	100.0

Table 2. Distribution of injuries by the work experience of injured workers

Work experience (Years)	Location of the accidents							
	Accidental injuries at workplace		Accidental injuries in traffic to work		Injuries in commuting accidents		Total	
	N	%	N	%	N	%	N	%
Under 1	135	28.5	9	26.5	3	10.7	147	27.4
1-9	129	27.2	8	23.5	3	10.7	140	26.1
10-19	72	15.2	7	20.6	7	25.0	86	16.0
20-29	74	15.6	5	14.7	7	25.0	86	16.0
30-39	64	13.5	5	14.7	8	28.6	77	14.4
Total	474	100.0	34	100.0	28	100.0	536	100.0

Table 3. Distribution of injuries by the time of day

Hour of day	Location of the accidents							
	Accidental injuries at workplace		Accidental injuries in traffic to work		Injuries in commuting accidents		Total	
	N	%	N	%	N	%	N	%
00-02	8	1.7	1	2.9	0	0.0	9	1.7
02-04	11	2.3	1	2.9	0	0.0	12	2.2
04-06	18	3.8	8	23.5	9	32.1	35	6.5
06-08	19	4.0	7	20.6	2	7.1	28	5.2
08-10	87	18.3	4	11.8	1	3.6	92	17.1
10-12	29	6.1	1	2.9	0	0.0	30	5.6
12-14	31	6.5	1	2.9	0	0.0	32	5.9
14-16	52	10.9	1	2.9	14	50.0	67	12.5
16-18	85	17.9	5	14.7	1	3.6	91	16.9
18-20	59	12.4	3	8.8	1	3.6	63	11.7
20-22	43	9.1	1	2.9	0	0.0	44	8.2
22-24	32	6.7	1	2.9	0	0.0	33	6.1
Total	474	100.0	34	100.0	28	100.0	536	100.9

Table 4. Distribution of injuries by the day of the week

Day of the week	Location of the accidents							
	Accidental injuries at workplace		Accidental injuries in traffic to work		Injuries in commuting accidents		Total	
	N	%	N	%	N	%	N	%
Sunday	32	6.7	2	5.9	1	3.6	35	6.5
Monday	88	18.6	6	17.6	5	17.8	99	18.4
Tuesday	85	17.9	7	20.6	4	14.3	96	17.9
Wednesday	78	16.5	5	14.7	6	21.4	89	16.6
Thursday	59	12.4	5	14.7	5	17.8	69	12.9
Friday	74	15.6	4	11.8	4	14.3	82	15.3
Saturday	58	12.2	5	14.7	3	10.7	66	12.3
Total	474	100.0	34	100.0	28	100.0	536	100.0

Table 5. Distribution of injuries by the month of the year

Month	Location of the accidents							
	Accidental injuries at workplace		Accidental injuries in the traffic to work		Injuries in commuting accidents		Total	
	N	%	N	%	N	%	N	%
January	24	5.1	3	8.8	4	14.3	31	5.8
February	27	5.7	2	5.9	4	14.3	33	6.2
March	29	6.1	3	8.8	2	7.1	34	6.3
April	49	10.3	2	5.9	1	3.6	52	9.7
May	58	12.2	4	11.8	2	7.1	64	11.9
June	44	9.3	2	5.9	1	3.6	47	8.8
July	31	6.5	3	8.8	2	7.1	36	6.7
August	27	5.7	2	5.9	2	7.1	31	5.8
September	47	9.9	2	5.9	1	3.6	50	9.3
October	54	11.4	3	8.8	2	7.1	59	11.0
November	53	11.2	3	8.8	3	10.7	59	11.0
December	31	6.5	5	14.7	4	14.3	40	7.5
Total	474	100.0	34	100.0	28	100.0	536	100.0

Table 6. Classification according to type of injury

Type of injury	Location of the accidents							
	Injuries in accident at workplace (N=474)		Injuries in accidents in traffic at work (N=34)		Injuries in commuting accidents (N=28)		Total (N=536)	
	Number	%	Number	%	Number	%	Number	%
Abrasions	43	9.1	1	2.9	0	0.0	44	8.2
Blisters	21	4.4	0	0.0	0	0.0	21	3.9
Contusions	27	5.7	4	11.8	0	0.0	31	5.8
Puncture wounds	32	6.8	0	0.0	0	0.0	32	5.9
Cuts	24	5.1	0	0.0	0	0.0	24	4.5
Lacerations	11	2.3	2	5.9	4	14.3	17	3.2
Closed fractures	81	17.1	8	23.5	0	0.0	89	16.6
Open fractures	72	15.2	5	14.7	0	0.0	77	14.4
Dislocated fractures	57	12.0	4	11.8	2	7.1	63	11.8
Sprains	9	1.9	2	5.9	8	28.6	19	3.5
Strains	11	2.3	3	8.8	7	25.0	21	3.9
Subluxations	8	1.7	1	2.9	3	10.7	12	2.2
Traumatic haemarthroses	12	2.5	0	0.0	0	0.0	12	2.2
Ruptures of joints and ligaments	21	4.4	0	0.0	4	14.3	25	4.7
Tears of joints and ligaments	20	4.2	0	0.0	0	0.0	20	3.7
Traumatic amputations	3	0.6	0	0.0	0	0.0	3	0.6
Ruptures and tears of internal organs	2	0.4	0	0.0	0	0.0	2	0.4
Burns	8	1.7	0	0.0	0	0.0	8	1.5
Bruises	12	2.5	4	11.8	0	0.0	16	2.9

Table 7 .Classification according to the part of body injured

Part of body	Location of the accidents							
	Injuries in accident at workplace (N=474)		Injuries in accidents in traffic at work (N=34)		Injuries in commuting accidents (N=28)		Total (N=536)	
	Number	%	Number	%	Number	%	Number	%
Head	17	3.6	0	0.0	0	0.0	17	3.2
Eye	14	2.9	0	0.0	0	0.0	14	2.6
Neck	18	3.8	0	0.0	0	0.0	18	3.3
Spine and vertebrae	10	2.1	0	0.0	0	0.0	10	1.9
Back	8	1.7	0	0.0	0	0.0	8	1.5
Trunk	15	3.2	0	0.0	0	0.0	15	2.8
Internal organs	3	0.6	0	0.0	0	0.0	3	0.6
Multiple-organ injuries	8	1.7	0	0.0	0	0.0	8	1.5
Upper extremities	110	23.2	8	23.5	3	10.7	121	22.6
Shoulder and shoulder joints	10	2.1	2	5.9	0	0.0	12	2.2
Arm and elbow	14	2.9	1	2.9	0	0.0	15	2.8
Wrist	15	3.2	2	5.9	0	0.0	17	3.2
Hand	18	3.8	2	5.9	5	17.8	25	4.7
Thumb	17	3.6	2	5.9	1	3.6	20	3.7
Upper extremities, multiple sites affected	15	3.2	5	14.7	0	0.0	20	3.7
Lower extremities	100	21.1	8	23.5	7	25.0	115	21.4
Hip and hip joint	15	3.2	0	0.0	0	0.0	15	2.8
Ankle	17	3.6	0	0.0	0	0.0	17	3.2
Foot	18	3.8	0	0.0	11	39.3	29	5.4
Toes	15	3.2	0	0.0	1	3.6	16	2.9
Lower extremities, multiple sites affected	17	3.6	4	11.8	0	0.0	21	3.9

These injuries resulted in 37 735 lost workdays, an average of 70.4 ± 5.8 days per injured worker. Accidents at workplace caused the highest number of lost workdays per injured worker (table 8).

Table 8. Time lost due to occupational injuries

Location of the accidents	Days away from work	
	$\overline{X}$	SD
Injuries in accident at workplace	71.5	8.7
Injuries in accidents in traffic at work	7.1	9.8
Injuries in commuting accidents	51.9	4.3
Total	70.4	5.8

DISCUSSION

In order to understand the risk factors of occupational accidents and injuries, to develop the prevention and control strategies and to estimate the effects of preventive measures, it is essential to know about and learn from past occupational accidents and injuries.

Here we report on the epidemiology of occupational injuries occurring in rubber industry from 1993 to 2003. Injury certificate data identified 536 workers who were injured in occupational accidents over the examined period. The circumstances of these 536 injuries provide valuable information that can be used to prevent occupational injuries in chemical industry.

One of the key finding in this study indicates that injuries are most frequent among the youngest worker. The literature data has well documented that age and accident rates are negatively related (probably because older workers are more experienced on the job and have greater job knowledge, patience, and skills than younger counterparts). When injuries do occur, older workers are usually more severely hurt, and fatalities occur more frequently among older workers. Some of the possible reasons why younger workers may be at increased risk of work related injury are limited job knowledge, training, and skills, and perhaps less sense of responsibility. These factors all point to the importance of safety attitudes in performing safety at work. Older workers are more satisfied with job and more likely to obey the general housekeeping rules and to check the safety equipment. Older workers could be more knowledgeable and experienced and display more positive attitudes to safety; they are possibly more committed to work than younger workers. Older workers are quite capable of learning safety regulations and safety system of work, and are willing to comply with safety regulations. Perhaps it is attributable to the fact that job knowledge structures increase with age and compensate for declines in ability. Perhaps the workers with working experience were more likely to hide lost days injuries that occurred (8–11).

One third of the workers had one or more occupational injuries in the first year of employment. These results are similar to the results of the other authors (12). Lack of work experience can be the contributing factor in the development of occupational injuries. Relevant training of the newly recruited workers and timely accurate education are needed to prevent occupational injuries (13). Efforts to prevent occupational injuries among the new workers will benefit from action by employers, regulatory agencies, the community at large, and young workers themselves. Employers can develop safety training programs that address young workers potential lack of experience and skills in recognizing and responding to hazards. Educational programs have traditionally focused high skill jobs rather than the types of workplaces where youths are more likely to gain employment. The requirements for becoming a skilled worker include meeting physical requirements regarding vision, hearing and coordination, participating in industrial vehicle training, and passing a test of knowledge and ability for job.

More injuries occurred in Monday, between 8 am to 10 am which is similar to the results of the other authors (14). These peaks in incident frequency for a particular time of day may simply reflect a higher number of persons working at those times rather than changing incidence during the day. The peaks in incident times could also be the result of different operations being performed at different times of the day, or might be due to changes in worker behavior. Without information concerning the number of workers employed at particular times of day or information regarding the exact operations performed at different periods throughout the day it is difficult to comment on the effects of time of day on the incidence of injuries (15).

Upper and lower extremities were the most often affected body parties. Closed fractures, open fractures and dislocated fractures were the most frequent injury types. These findings are similar to the results of the other authors (16, 17).

Occupational accidents were associated with exceptionally severe injuries as reflected by the

great number of lost workdays. These injuries resulted 70.4± 5.8 days per injured workers. These results are higher than the results of the other authors who found that 41 % injuries resulted in an employee missing work and incurred a 61 days per lost workday incident (18).

CONCLUSION

Traumatic occupational injuries are a significant problem in rubber industry, especially in the transition period. This study confirms that injuries are most frequent among the youngest workers with less job experience. Inexperience and lack of training may be the risk factors for occupational accidents.

These findings are important for the control and prevention of occupational injuries in rubber industry.

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POVREDE NA RADU U GUMARSKOJ INDUSTRIJI

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SA@ETAK

Cilj ovog rada je da analizira epidemiolo{ke karakteristike povreda radnika u gumarskoj industriji u periodu od 1993. do 2003. godine. Povrede i incidenti na radnom mestu su naj~e{}e prisutni kod mladih radnika sa malim radnim iskustvom. Povrede se naj~e{}e doga|aju, tokom meseca maja, u ponedeljak, u periodu izme|u 8 i 10 sati. Naj~e{}i tip povreda su zatvorene i otvorene frakture i frakture sa dislokacijom. Gornji i donji ekstremiteti su naj~e{}e povre|eni delovi tela u ovim povredama. Prose~an broj izgubljenih radnih dana usled ovih povreda na radu je 70.4 ± 5.8 dana po povre|enom radniku, {to je znatno vi{e u odnosu na podatke iz literature. Rezultati ovoga rada mogu na}i svoju prakti~nu primenu u prevenciji i kontroli povreda na radu u gumarskoj industriji.

Klju~ne re~i: povrede na radu, gumarska industrija, radnici, nezgode na poslu